

*Public Comment Release Draft*

# **PUBLIC HEALTH ASSESSMENT**

**Mercer Rubber Company Site  
Hamilton Square, Mercer County, New Jersey**

**August 2, 2006**

**Prepared by:**

**New Jersey Department of Health and Senior Services  
Public Health Services Branch  
Consumer and Environmental Health Services  
Hazardous Site Health Evaluation Program**

**Under a Cooperative Agreement with the  
Agency for Toxic Substances and Disease Registry**

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## Summary

In February 2004, a concerned citizen petitioned the federal Agency for Toxic Substances and Disease Registry regarding potential environmental exposures to hazardous chemicals associated with the former Mercer Rubber Company, Hamilton Square, Mercer County, New Jersey. As described by the petitioner, the results of a survey conducted by private individuals of the surrounding community indicated excessive reported cancer cases (e.g., leukemia, breast, lymphoma) allegedly related to contaminated soil and surface and groundwater contamination from past manufacturing processes and on- and off-site waste disposal practices. The Mercer Rubber Company was founded in 1866 and manufactured natural rubber products from the 1860s through the 1930s; the company manufactured synthetic rubber products from the 1930s until plant closing in early 1993. The petition was accepted in May 2004 and through a cooperative agreement, the New Jersey Department of Health and Senior Services prepared the following public health assessment for the site.

In August 1993, a site investigation of the Mercer Rubber Company was conducted pursuant to the New Jersey Environmental Cleanup Responsibility Act, later amended by the Industrial Site Recovery Act. Fourteen on-site Areas of Concern were identified and a Remedial Investigation for the site was initiated. Environmental samples were collected and analyzed for volatile organic compounds, semivolatile compounds, metals, and petroleum hydrocarbons. Contaminated areas were remediated and/or the contamination was determined to be below state soil criteria. No Further Action letters were issued by the New Jersey Department of Environmental Protection in 1996 and 2000, and the site was later developed for residential housing. Based on a review of on-site soil contamination and remedial actions taken, the New Jersey Department of Health and Senior Services, in cooperation with the Agency for Toxic Substances and Disease Registry, have determined that there is ***“No Apparent Public Health Hazard”*** to current residents of on-site homes.

Interviewed former Mercer Rubber Company employees and/or long-time area residents indicated that manufacturing process wastes were dumped off-site. Area surface water bodies used for recreational purposes (fishing, ice skating) were described as turning cloudy white from plant manufacturing process discharges. Off-site environmental sampling of soil, surface water, and area private domestic wells was not conducted, and environmental data were not available to assess these potential exposure pathways. As such, past, present, and future exposures at off-site areas represent an ***“Indeterminate Public Health Hazard”***.

Based on Toxic Release Inventory data available for toluene for the Mercer Rubber Company, there was a completed inhalation exposure pathway to area residents in the past. Modeled off-site ambient toluene concentrations were determined to be below levels of health concern. In addition to toluene, other hazardous chemicals (including the carcinogens benzene, 1,3-butadiene, and acrylonitrile) were likely to have been emitted from the plant during past rubber product manufacturing processes. Since production records and air permits are not available for the Mercer Rubber Company, off-

site residential exposures from these emissions could not be assessed. Manufacturing operations and emissions to ambient air at the Mercer Rubber Company ceased in 1993, hence, present and future exposures via this pathway were eliminated.

A separate health consultation reviewed cancer incidence data for the neighborhoods surrounding the former Mercer Rubber site. Total cancer and 13 site-specific cancers types were evaluated over a 23-year period, 1979-2001. No overall cancer excess was observed. Of the 27 analyses conducted, only two were statistically significantly higher than expected. These include bladder cancer in males, and brain and central nervous system cancer in females. Leukemia was slightly elevated in both males and females, but the differences from expected were not statistically significant. Breast cancer, a cancer of concern to the community, was not elevated. The analysis provides little evidence that cancer incidence in the area was affected by environmental exposures associated with the Mercer Rubber Company site.

Recommendations for the Mercer Rubber Company site consist of the collection of soil samples in off-site areas where wastes were allegedly dumped and the sampling of area shallow groundwater to assist in evaluating the potential for vapor intrusion of contaminants into residential homes. It should be noted that although environmental sampling is recommended, it is not possible to evaluate past exposures with current contamination data. The data can be used, however, to evaluate possible current site-related exposures.

## Statement of Issues

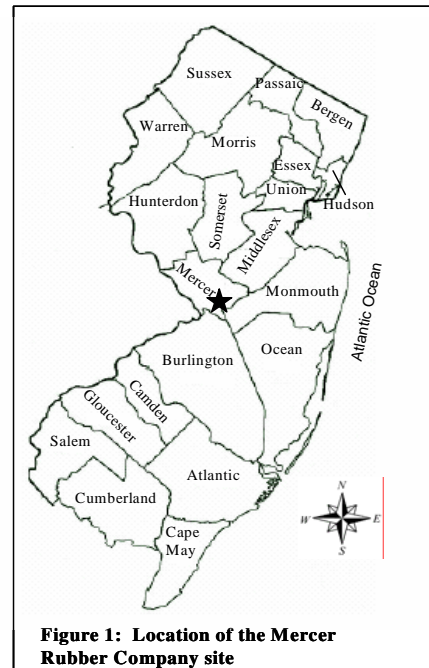
In February 2004, a concerned citizen petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) regarding potential environmental exposures to hazardous chemicals associated with the former Mercer Rubber Company, Hamilton Square, Mercer County, New Jersey. As described by the petitioner, the results of a survey conducted by private individuals of the surrounding community indicated numerous reported cancer cases (e.g., leukemia, breast, lymphoma) allegedly related to contaminated soil and surface and groundwater from past manufacturing processes and on- and off-site waste disposal practices. The Mercer Rubber Company was founded in 1866 and manufactured natural rubber products from the 1860s through the 1930s; the company manufactured synthetic rubber products from the 1930s until plant closing in early 1993. Site-related contaminants included petroleum hydrocarbons, base/neutral compounds (associated with lubricants and fuel oils), volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and metals (associated with catalysts and certain vulcanization processes). The petition was accepted by the ATSDR in May 2004.

The New Jersey Department of Health and Senior Services (NJDHSS), in cooperation with the ATSDR, prepared the following public health assessment for the Mercer Rubber Company site. The purpose of this public health assessment was to evaluate public health implications associated with possible past, present, and future exposure pathways of concern. A separate health consultation was prepared to evaluate cancer incidence in the surrounding community (ATSDR 2006).

## Background

### Site History

The Mercer Rubber Company was located at 136 Mercer Street, Hamilton Square, Mercer County, New Jersey (see Figure 1). The 2.5 acre site had been in operation at this location since 1866. The company specialized in the manufacture of molded rubber mechanical products, rubber sheeting, and conveyor belting (see Figure 2). In the early 1930s, the company began building rubber expansion joints. More recent operations at the site involved rubber processing for the manufacture of hoses and specialty fittings, gaskets, and expansion joints (ELM 1995). The company was owned by the Sayen family until 1977 when it was sold to Mr. Brennan; it was again sold in 1983 to Mason Industries, Inc. Mason Industries, Inc. continued the manufacture of rubber products until January 1993. In June 2000, Mason Industries, Inc. sold the



**Figure 1: Location of the Mercer Rubber Company site**

property to JK Custom Building and Remodeling. JK Custom Building and Remodeling demolished on-site buildings in 2000 and later built 11 single family homes on the site (see Photograph 1).

An adjacent 30 acre parcel of land was purchased by a Sayen family member in 1912. In 1981, the township of Hamilton purchased the 30 acre parcel; it is currently known as the Sayen House and Gardens and comprises the historic Sayen House, gardens, ponds, gazebos, and walking trails (see Photographs 2 and 3) (Sayen House and Gardens 2005).

## **Site Description**

The Mercer Rubber Company site is situated in the Atlantic Coastal Plain Physiographic province, which is characterized by low-lying, gently rolling topography underlain by unconsolidated to partially consolidated sediments. The sediments vary among clay, sandy-clay, sand, and gravel. These sediments are overlain by recent age Pleistocene deposits composed principally of sands and silty sands. Depth to bedrock in this area of Mercer County is expected to exceed 100 feet (New Jersey Geological Survey 1965).

The soil at the site consists of fine, silty sand, fine sand with clay, and clayey silt. The topography of the site and the surrounding area is relatively flat (less than one percent grade). Groundwater depth is about 10 - 15 feet at the site. The unnamed creeks in the vicinity of the Mercer Rubber Company site flow through the community (see Photograph 4) and eventually drain into the Miry Run Brook located about one mile north of the site (see Figure 3). Based on regional topography, shallow groundwater was predicted to flow north (ELM 1995). Runoff from on-site paved areas either entered on-site storm drains or to a storm drain located in Mercer Street. The storm drain discharges into an unnamed creek; the unnamed creek flows along residential backyards and into the Miry Run Brook.

The source of area community water supply wells is the Potomac-Raritan-Magothy aquifer system (USGS 2005). The confining layer is composed of slightly permeable interbeds of silt and clay, which restrict the vertical flow of water.

## **Site Remediation**

On March 18, 1993, the New Jersey Department of Environmental Protection (NJDEP) issued a notice of violation to the Mercer Rubber Company for ceasing site operations without prior NJDEP notification. This comprised a violation of the Environmental Cleanup Responsibility Act (ECRA), later amended by the Industrial Site Recovery Act (ISRA) (NJDEP 1993a). In response, Mason Industries, Inc. conducted site investigation (ELM 1993) and subsequent remedial activities (ELM 1995; ELM 1996). The remedial workplan was based on a review of site records and historical documents, interviews with company personnel, and a site inspection. Areas of concern (AOCs) were selected for soil investigation (see Figure 4). Soil sampling was performed

in all AOCs and contaminated soil was removed when deemed necessary. Additionally, one above ground storage tank (AST) and two underground storage tanks (USTs) were removed and one UST was closed in place. On June 4, 1996, a “No Further Action” (NFA) letter was issued by the NJDEP (NJDEP 1996). A second “No Further Action” letter, as well as a Covenant Not to Sue, was issued by the NJDEP on June 5, 2000 (NJDEP 2000a). Area groundwater was not required to be sampled prior to the issuance of the NFA letter since on-site soil sampling did not indicate subsurface contamination; additionally, there is a dense clay layer underneath the site (W. Hadsell, NJDEP, personal communication, 2004).

## **Demographics**

Using 2000 United States Census data, the ATSDR estimates that there are about 11,000 individuals residing within a one mile radius of the Mercer Rubber Company site (see Figure 5).

## **Rubber Product Manufacturing Industry**

Most rubber products produced in the United States are composed of one or more of 23 generic rubber compounds (USEPA 1999). The processes utilized in tire and engineered rubber productions are similar, although there are several basic differences which include the raw material used (natural versus synthetic rubber), chemical additives, and curing process. Specific compound recipes (used for the manufacture of tire components, acrylate rubber, hydrogenated nitrile, etc.) are available, and associated emission factors have been derived. During manufacturing operations, VOC emissions occur from the use of chemical additives (i.e., cements, solvent tackifiers, release agents) and are associated with the following unit processes:

- mixing;
- extrusion;
- calendering;
- curing (e.g., platen press, autoclave furnaces, hot air); and
- grinding.

**Mixing** consists of mixing raw rubber with several chemical additives. These additives include an accelerator (accelerates the vulcanization rate), zinc oxides (assists in accelerating vulcanization), retarders (prevents premature vulcanization), antioxidants (prevents aging), softeners (facilitates processing of the rubber), carbon black or other fillers (reinforcing/strengthening agents), and inorganic or organic sulfur compounds (vulcanizing agents). Mixing is typically performed in an internal batch mixer at elevated temperatures up to approximately 330°F. Once properly mixed, the rubber can be extruded. **Extrusion** is the process of shaping by forcing through a die; it is usually performed to combine several types of mixed rubber compounds. **Calendering** is a finishing process by which rubber is pressed into sheets and smoothed, glazed, polished, or given an embossed surface. The rubber is passed through a series of rollers (calenders employ either three or four rolls and are hollow to allow for heating or cooling); the

resulting surface depends on the pressure exerted by the rollers, on their temperature, composition, and surface designs, and on the type of coating or glaze previously applied to the material to be calendered. The final step in the manufacture of rubber products is vulcanizing, or **curing**. There are three predominant vulcanizing processes: press mold curing, autoclave furnace curing, and hot air curing. Autoclave furnace curing is the predominant curing method in non-tire rubber manufacturing facilities and was utilized by the Mercer Rubber Company. This type of curing uses saturated steam at an elevated pressure to cure the rubber mix. Unlike press mold curing, the product is formed into its final shape prior to the curing process. **Grinding** is often performed to remove rough edges and other blemishes from the final product or in some cases to actually form and shape the product. The ground rubber is occasionally recycled and utilized as filler in some rubber manufacturing processes.

VOCs and other pollutant emissions associated with each of the unit processes (i.e., mixing, extrusion, calendaring, curing, grinding) for rubber product manufacturing have been identified (USEPA1999; Environment Australia 2002) (see Table 1).

### **Site Visit**

In early May 2004, photographs of the site and surrounding area were obtained by the NJDHSS to provide the ATSDR Petition Committee with a general overview of the site. On June 25, 2004, the petitioner showed NJDHSS staff the underground pipes entering the unnamed creek (see Photograph 5) and alleged areas of past waste disposal.

On July 19, 2004, a site visit to the former Mercer Rubber Company site and nearby Sayen Park was conducted. Present were Steven Miller, Somia Aluwalia, Sharon Kubiak, Michael Berry and Patricia Haltmeier of the NJDHSS, Arthur Block and Leah Escobar of the ATSDR, as well as representatives of the NJDEP and Hamilton Township Department of Health. Weather conditions were overcast and humid with temperatures in the upper 70s. The ground and vegetation were wet due to heavy rainfall the previous day.

Eleven houses on a cul-de-sac are now located on the site of the former Mercer Rubber Company. The site is bordered to the northwest by Mercer Street, to the northeast by the Nottingham Firehouse, and to the south and west by private residences. Sayen House and Gardens is located across Mercer Street. The unnamed creek and Sayen Gardens were inspected, and underground pipes were observed entering the unnamed creek. The unnamed creek continues in a northwest direction behind a residential neighborhood and Township Athletic Baseball fields. Several residential yards abut the unnamed creek where there is a chain-link fence. The fence continues behind the Township Athletic Baseball field; some sections of the fence were down and rusted, providing easy access to the creek and its banks. Downstream, the unnamed creek joins with an unnamed tributary, eventually draining to the Miry Run Brook. A pond (also referred to as the ice skating pond in this report) is located near the Township Baseball Athletic fields in which a 55 gallon drum was observed (see Photograph 6). A

gazebo and a second pond located to the west of the Sayen House were also observed (see Photographs 7 and 8).

### **Interviews of Former Mercer Rubber Company Employees**

On behalf of the NJDHSS, the petitioner contacted seven former employees and/or long-time area residents to request permission to be interviewed about on-site manufacturing processes, chemical usage, and site-related impacts to the surrounding neighborhood. Five individuals agreed to be interviewed, one declined, and another could not be reached. Four of the five individuals interviewed by the NJDHSS were former employees, and three of these four were also long-time area residents. Duration of employment at the Mercer Rubber Company ranged from approximately four to 40 years; residency of individuals interviewed was the 1950s through present day.

### **Plant Processes**

According to conversations held with the former workers, there were about 160 individuals employed at the Mercer Rubber Company (circa 1970). The company manufactured rubber products (conveyor belts, garden hosing, connector hoses, washers and grommets, floor mats, doormats, and expansion joints) from rubber brought in as raw material.

Two primary work areas at the site were the mill room and the hose room. In the mill room, “solid chunks” of raw rubber were placed in a mixer/hopper along with powders and liquids (mostly powders), heated, then rolled out as sheets through calenders (extruding rollers) in elastomer form. In the hose room, the elastomer sheets were either fabricated into products or used as intermediates for further processing. Toluene and/or gasoline were used to make the elastomer “sticky” so that it could be either rolled and sealed along a seam (e.g., to form hoses), or stamped out to make gaskets and grommets. Steam was also used in vulcanization (after the products were fabricated) to harden the rubber. Soapstone was used to keep fabric pieces and rubber sheets from sticking together. High (“boiling”) temperatures were used for both softening (during milling) and vulcanization of products. Cooling and ventilation fans and hoods were used, but one individual maintained that the primary form of ventilation used during his tenure was open windows, and this was mainly to relieve the heat.

### **Chemical Storage**

Chemicals reportedly used at the site included toluene, gasoline, and “rubber gas” (possibly gasoline or butadiene), as well as isoprene, naphtha and methyl ethyl ketone. Chemicals were stored on-site in underground storage tanks (USTs), 55 gallon drums (some with spigots), tanks, or closed cans. Limited information was available from NJDEP Right-To-Know inspection reports and manifests registered with the NJDEP (NJDEP 1992). These documents do not reveal the quantity of compounds used or released, but they indicate that the compounds were stored on-site (see Table 2).

As mentioned earlier, the on-site chemical storage areas were investigated and remediated (ELM 1995; ELM 1996).

### Waste Disposal

One individual stated that many drums of liquid, referred to as “brown goo”, were dumped onto the ground approximately 500 feet to the north of the Sayen House (see Photograph 9 and 10) for three years (1969, 1970 and 1971). After this period, the waste was collected by trucks and taken to Duck Island, Trenton, Mercer County. The drums contained two to three gallons of oil, and organic solvents and water.

One individual stated that hydraulic presses were very old and leaked large amounts of lubricating oil (“similar to engine oil”). The oil was collected in a large pit and a hose was used to carry it to one of several floor drains. The floor drains reportedly lead to a creek across Mercer Street. One individual said that this practice was stopped in 1969 and instead the oily liquid was put into drums and then dumped onto the ground about 150 yards from the Sayen House. One individual stated that there was a large drain on the site that went under Mercer Street and drained into the unnamed creek (see Photograph 5). This statement was supported by another individual, who stated that the Mercer Rubber Company put liquid wastes into the unnamed creek as a means of disposal.

Two individuals reported that solid wastes (bulk rubber) were kept in dumpsters and hauled away. One of these individuals mentioned that prior to 1953, the bulk rubber was burned in the back of the factory. Two other individuals stated that solids were dumped at a location approximately 500 feet to the north of the Sayen House and in the ice skating pond near the Township Athletic Baseball field.

### **Community Concerns**

#### Environmental Concerns

Community complaints included the dumping of solids and liquid wastes both on- and off-site areas. These complaints included release of lubricating oil and milky white substance to a small unnamed creek, dumping of waste including rubber pieces and liquid waste (“brown goo”) onto the ground approximately 500 feet to the north of the Sayen House, and in the ice skating pond. In addition, residents also complained about on-site burning (prior to 1953) and disposal of rubber.

During the 1990s, the NJDEP conducted several site inspections in response to community complaints. In 1991, NJDEP responded to an anonymous complaint about dumping of rubber/open pits from old Mercer Rubber plant (NJDEP 1991). The inspection revealed several old rubber mats (3 x 2 foot) strewn in the area between the Sayen House and the Township Baseball Athletic fields. The rubber mats appeared to be there for several years. A 12 x 15 foot open pit with one foot of standing water was observed. A small body of water (the ice skating pond) near the Township Baseball

Athletic fields was also observed during this inspection. This body of water was reportedly runoff from the Mercer Rubber Company. According to a Hamilton Township Parks and Recreation Services employee, the pit was dug out to plant trees and the water in the open pit was due to excessive rain. The County Park Coordinator reported that no drums or foam debris were encountered while developing the area and that the rubber pieces (found mixed with soil) would be removed from the area. The complaint was referred to the NJDEP Division of Solid Waste for their follow up.

On January 13, 1993, the NJDEP issued a Notice of Violation to Mercer Rubber Company for an incident involving waste oil washing onto the Mercer Street sidewalk and into the street's stormwater drain. A similar incident occurred on April 28, 1993 (NJDEP 1993); the NJDEP inspector suggested that this might have been a recurring problem. In response to area resident complaints regarding alleged past company discharges, the NJDEP conducted an inspection of the Mercer Rubber Company site in August 2000. At the time of the inspection, site buildings had already been demolished; unknown piping coming from the ground in various places throughout the former building perimeter were observed (NJDEP 2000b). Three eyewitness accounts were documented as part of this investigation which described the creek as sometimes clouded by a milky white substance that had a strong odor. The origin of the milky white substance was ascribed to plant discharges through underground piping to the stream. The burial of rubber wastes in the rear portion of the site was also described. In response to a NJDEP request to investigate this matter, Mason Industries, Inc. stated that these events occurred prior to their ownership and that the milky white substance was probably press oil that, when added to water, formed an emulsion. Results of a subsequent NJDEP investigation into this matter determined that since outflow pipes also received rainwater discharges from Mercer Street, dilution of any hazardous discharges from the Mercer Rubber Company would have occurred; NJDEP concluded that natural attenuation within the last few decades would make any potential contamination released from the site a minimal threat to human health (NJDEP 2003).

#### Interviews with long-time area residents (exposure information)

Individuals interviewed stated that dumping had occurred in the unnamed creek, the areas to the north and west of the Sayen House and in the ice skating pond; however, it is unclear if the dumping had occurred in the pond adjacent to the Sayen House. Two individuals reported either playing in the creek themselves or seeing children fishing in the pond adjacent to the Sayen House.

Stack emissions from coal fired furnaces, which reportedly occurred in the past, were such that the residents within one block had to frequently clean black soot off their automobiles and homes. Toluene and gasoline odors were noticeable outdoors. Other individuals described odors emanating from the former Mercer Rubber Company as "burning rubber", "rotten eggs", "gasoline", and "tar".

## Health Concerns

According to the concerned citizen's petition letter, community members canvassed a small area of their neighborhood and found self-reported cases of leukemia, breast cancer, and other cancers at a level that they felt was excessive. They suspected that contamination of well water (both private and public) associated with the disposal of rubber and rubber by-products contributed to these disease occurrences.

## **Environmental Contamination**

An evaluation of site-related environmental contamination consists of a two tiered approach: 1) a screening analysis; and 2) a more in-depth analysis to determine public health implications of site-specific exposures. First, maximum concentrations of detected substances are compared to media-specific environmental guideline comparison values (CVs). If concentrations exceed the environmental guideline CV, these substances, referred to as Contaminants of Concern (COC), are selected for further evaluation. Contaminant levels above environmental guideline CVs do not mean that adverse health effects are likely, but that a health guideline comparison is necessary to evaluate site-specific exposures. Once exposure doses are estimated, they are compared with health guideline CVs to determine the likelihood of adverse health effects.

## **Environmental Guideline Comparison**

There are a number of CVs available for the screening environmental contaminants to identify COCs. These include ATSDR Environmental Media Evaluation Guides (EMEGs) and Reference Media Evaluation Guides (RMEGs). EMEGs are estimated contaminant concentrations that are not expected to result in adverse noncarcinogenic health effects. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects. If the substance is a known or a probable carcinogen, ATSDR's Cancer Risk Evaluation Guides (CREGs) were also considered as comparison values. CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million ( $10^{-6}$ ) persons exposed during their lifetime (70 years). In the absence of an ATSDR CV, other comparison values may be used to evaluate contaminant levels in environmental media. These include New Jersey Maximum Contaminant Levels (NJMCLs) for drinking water, and USEPA Region 3 Risk-Based Concentrations (RBCs). RBCs are contaminant concentrations corresponding to a fixed level of risk (i.e., a Hazard Quotient<sup>1</sup> of 1, or lifetime excess cancer risk of one in one million, whichever results in a lower contaminant concentration) in water, air, biota, and soil. For soils and sediments, other CVs include the NJDEP Residential and Non-Residential Direct Contact Soil Cleanup Criteria (RDSCC, NRDSCC). Based primarily on human health impacts, these criteria also take into account natural background concentrations, analytical detection limits, and ecological effects.

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<sup>1</sup>The ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level at which no adverse health effects are likely to occur.

Substances exceeding applicable environmental guideline CVs were identified as COCs and evaluated further to determine whether these contaminants pose a health threat to exposed or potentially exposed receptor populations. In instances where an environmental guideline CV was unavailable, the substance may be retained for further evaluation.

## **On-Site Contamination**

On-site buildings designated by letters A through P (see Figure 4) included a warehouse (building A), shipping area and machine shop (building B), shipping area and loading dock (building C), (hydraulic) press room (building D), hose room/support areas (building E), office/storage room (building F), belt department/support areas (building G), belt department (building H), hose department (building I), outside aisle (building J), mill room (building K), carbon black storage room (building L), former belt press room (building M), warehouse addition (building N), chemical storage area (building O), and boiler room (building P). Approximately half of the site was covered by these buildings; the remaining site area was unpaved or pavement in disrepair (ELM 1993).

In August 1993, a site investigation of the Mercer Rubber Company was conducted pursuant to ECRA, later amended by ISRA (ELM 1993). Fourteen on-site Areas of Concern (AOC) were identified where hazardous substances contamination possibly occurred and environmental sampling was recommended. Two loading docks (AOC E) and former machine pits (AOC K) were inspected; no significant staining of soil and/or contamination was noted. As such, these areas were not identified for additional sampling. A Remedial Investigation for the site was initiated in November 1993, and samples collected from the AOCs were analyzed for VOCs, semivolatile organic compounds (SVOCs), metals, and petroleum hydrocarbons (PHC).

## ***Soil***

Contaminants detected in the soil of AOCs A, B, J, and L did not exceed NJDEP Soil Criteria<sup>2</sup> (see Table 3). Based on photoionization detector (PID) and laboratory analytical results, four of the soil samples collected from AOC C exceeded the NJDEP Soil Criteria for VOCs (see Table 3). While PHCs were detected in soils at all AOC tested, maximum concentrations exceeded the NJDEP Soil Criteria in only AOCs D, F, G, M, and N (see Table 3). Twelve soil samples were analyzed for SVOCs; maximum concentrations detected in AOCs C, D, G, and M exceeded the NJDEP Soil Criteria (see Table 3). PCBs detected in the soil of AOC H (under a pole-mounted transformer) exceeded the NJDEP Soil Criteria (see Table 3). Fifteen soil/sediment samples were collected and analyzed for metals; maximum concentrations detected in AOC C, D, I, M, and N exceeded the NJDEP Soil Criteria (see Table 3).

The following are summaries of AOCs described in the Remedial Action Report (RAR) (ELM 1995). These AOCs were found to have contaminant concentrations above

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<sup>2</sup>Later known as NJDEP Residential Direct Contact Soil Cleanup Criteria.

NJDEP Soil Criteria. The potential for off-site contaminant migration and remedial actions implemented was previously evaluated by the NJDEP (ELM 1996). An assessment of the RAR information was conducted by the NJDHSS and COCs were identified for further evaluation.

### **AOC C - Former Drum Storage**

The paved and unpaved areas between Buildings H and N were designated as AOC C (see Figure 4). VOCs (acetone, 1,1-dichloroethane, methylene chloride, xylenes) and SVOCs (benzo[a]pyrene, benzo[a]anthracene) were detected in the paved area at concentrations exceeding NJDEP Soil Criteria. However, these contaminant concentrations were below NJDEP soil criteria established to protect groundwater quality. Although concentrations of 1,1-dichloroethane, tetrachloroethene (or PCE), and xylenes in soils collected in the unpaved area of AOC C (1.5 - 2 feet below ground surface) exceeded NJDEP Soil Criteria, all but PCE were below NJDEP soil criteria established to protect groundwater quality. The average PCE concentration (1.1 mg/kg) exceeded the soil criteria of 1 mg/kg established to protect groundwater quality, however, this difference was not considered significant (see Table 4). The maximum surface soil (0 - 6 inches depth) lead concentration (1,020 mg/kg) exceeded the NJDEP Soil Criteria (see Table 5), although the average concentration of the three samples collected (382 mg/kg) was below the criteria.

Based on the information provided in the RAR, soil contamination in AOC C was limited within two feet below grade and unlikely to have impacted area groundwater quality. Additionally, later development activities may have redistributed the lead hotspot. No remediation activities were implemented for AOC C. Although maximum concentrations of benzo[a]anthracene, benzo[a]pyrene, benzo[a]fluoranthene, and benzo[k]fluoranthene detected in the surface soil exceeded the RDCSCC (see Table 4), the concentrations were within the reported range typical for United States urban soils (ATSDR 1995). Since the maximum concentrations of PCE and lead detected in the surface soil exceeded the RDCSCC (see Tables 4 and 5), these contaminants were identified as COCs.

### **AOC D - Former Storage Area**

The paved area located in the southeast section of the site adjacent to Building A was designated as AOC D (see Figure 4). No VOCs were detected in AOC D based on PID and laboratory analytical results.

A sample of a hardened, tar-like material bound to the pavement (covering a two foot square area) was collected and analyzed for VOCs, SVOCs, metals, PHCs, and PCBs. With the exception of PHC (detected at a concentration of 73,000 mg/kg), contaminant concentrations were below NJDEP Soil Criteria. VOCs and SVOCs typically associated with petroleum products were not detected in the material. Additionally, the material was not considered as mobile or bioavailable.

Three samples analyzed for metals were found to contain mercury at concentrations of 26.9, 0.11, and 0.12 mg/kg. Although the maximum of these concentrations (26.9 mg/kg) was above the NJDEP Soil Criteria (see Table 5), the average concentration (13.5 mg/kg) was below the criteria (ELM 1995). Since no other soil mercury exceedances were reported for the other AOCs, the mercury contamination was not considered to be associated with former manufacturing processes.

Based on the information provided in the RAR, mercury contamination was unlikely to have impacted area groundwater or migrated off-site, although subsequent development activities may have redistributed the mercury hotspot. No remediation activities were implemented for AOC D. Since the maximum concentration of mercury detected in the soil exceeded the RDCSCC (see Table 5), this contaminant was identified as a COC.

### **AOC F – Former Outside Pit**

A small concrete pit (approximately three by three by four feet in size) located along the western fence line at the juncture of Buildings D and J was designated as AOC F (see Figure 4). During past manufacturing operations, condensate drain lines from three vulcanizers discharged to this pit. AOC F contained fine blackish material at 16 inches below ground surface. Based on laboratory analytical results, no elevated VOCs or SVOCs were detected in the soil of AOC F. Analysis of the fine material from within the pit determined 130,000 mg/kg of PHCs (see Table 4); VOCs and SVOCs typically associated with petroleum products were not detected in this material.

Excavation of the pit to a depth of seven feet revealed a brick-lined, six foot in diameter pit filled with fine black material. Based on a microscopic examination of the material and ELM discussion with Mercer Rubber Company personnel, the material was determined to be small rubber particles and/or carbon black<sup>3</sup> that had been carried on condensate.

Based on the information provided in the RAR, PHC concentrations from ground surface to a depth of seven feet decreased from 130,000 to about 2,200 mg/kg and were unlikely to have posed a threat to groundwater or migrated off-site. Twenty-five cubic yards of the black fine material was excavated and disposed at an off-site facility. No COCs were identified for AOC F.

### **AOC G - Boiler Blowdown Pits**

Two concrete pits located near the eastern fence line were designated as AOC G (see Figure 4). The first pit was approximately six feet in diameter and eight feet deep; the second pit was approximately five feet in diameter and 14 feet deep.

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<sup>3</sup>Carbon black was used as a filler material in the manufacture of rubber products to increase resistance to abrasion and tearing.

Results of samples (0 - 6 inch depth and 18 - 24 inch depth) collected from the first pit indicated the presence of VOCs and SVOCs; all detected concentrations were below NJDEP Soil Criteria. PHC concentrations in surface and subsurface soil samples were 38,000 and 80 mg/kg, respectively. PHC contaminated soil was excavated and disposed at an off-site facility. To assess contamination outside the pit, two test pits were dug to a depth of 8.5 feet on the north and south side of the pit; samples were field screened for VOCs and analyzed for PHCs. No VOCs were detected; PHC results were below the NJDEP Soil Criteria.

With respect to the second pit, a sample was collected from its 10 inch sediment layer, field screened for VOCs, and analyzed for SVOCs and PHCs. No VOCs were detected; the PHC result (72,700 mg/kg) was above the NJDEP Soil Criteria of 10,000 mg/kg (see Table 4). Of the 13 SVOCs detected, only an estimated concentration of benzo[a]anthracene exceeded the NJDEP Soil Criteria. Contaminated soil was excavated (revealing a brick-lined base) and disposed. To assess the vertical extent of PHC contamination, bricks were removed and a soil sample collected; the result was 487 mg/kg PHC.

Based on the information provided in the RAR, it is unlikely that PHC contamination detected in the boiler blowdown pits posed a threat to groundwater or migrated off-site. No COCs were identified for AOC G.

#### **AOC H - Former Transformers**

There were four transformers on the Mercer Rubber Company site. Area H1 was the location of three transformers installed on a concrete pad; these transformers were removed by a utility company and disposed off-site. A small, pole mounted transformer located in Area H2 was removed by a contractor and disposed off-site (see Figure 4).

Since no soil staining was observed in Area H1, four soil samples collected from this area were analyzed for PCBs only; results were below the NJDEP Soil Criteria. The results of two of three soil samples (11 and 1.4 mg/kg) collected from Area H2 exceeded the NJDEP Soil Criteria for PCBs (see Table 4). During subsurface soil collection activities, a concrete pad was discovered; it was believed that the concrete pad prevented the migration of PCBs to deeper soils. About a quarter of a cubic yard of contaminated soil from the surface of the concrete pad and alongside of the transformer pole was excavated and removed from Area H2.

Based on the information provided in the RAR, it is unlikely that PCB contamination detected in the Areas H1 and H2 posed a threat to groundwater or migrated off-site. No COCs were identified for AOC H.

#### **AOC I - Former Dust Collector**

The location of a dust collector along the western wall of Building J (see Figure 4) was designated as AOC I. This location was reportedly last used in the 1970s. One

surface soil sample collected from AOC I was analyzed for VOCs, SVOCs, PHCs, metals, and PCBs. Based on PID and laboratory analytical results, VOCs, PHCs, and PCBs were below NJDEP Soil Criteria. Although three SVOCs (benzo[a]anthracene, benzo[k]fluoranthene and benzo[a]pyrene) exceeded the NJDEP Soil Criteria (see Table 4), the maximum concentrations detected for these contaminants were within the reported range typical for United States urban soils (ATSDR 1995). With the exception of cadmium, metals were detected at concentrations below NJDEP Soil Criteria. Although the concentration of cadmium detected (1.4 mg/kg) exceeded 1 mg/kg (the NJDEP Soil Criteria at that time), no remedial activities were implemented for AOC I (see Table 5).

Based on the information provided in the RAR, maximum concentrations of benzo[a]anthracene, benzo[a]pyrene, benzo[a]fluoranthene, and benzo[k]fluoranthene (see Table 5) detected in AOC I are typical of urban soils (ATSDR 1995). Additionally, the RDCSCC for cadmium has been revised to 39 mg/kg. As such, no COCs were identified for AOC I.

### **AOC M - Interior Cistern**

An eight foot deep, 12 foot in diameter concrete cistern located under the floor of Building H was designated as AOC M (see Figure 4). The cistern was found to contain two feet of standing water and three feet of sediment. The use of the cistern was unknown to former Mercer Rubber Company employees (including a 30-year veteran) who spoke with ELM. Possible past use of the cistern included water storage for firefighting and storage of noncontact cooling water. One water sample was collected and analyzed for VOCs; one sediment sample was also collected and analyzed for SVOCs, PHCs, and metals. PID and laboratory analytical results for the water sample indicated the absence of VOCs. The PID screening result for the sediment sample indicated the absence of VOCs. Results of laboratory analysis of the sediment sample indicated NJDEP Soil Criteria exceedances for SVOCs (bis[2-ethylhexyl]phthalate) and metals (antimony, lead, copper); PHC (576,000 mg/kg) also exceeded the NJDEP Soil Criteria (see Tables 4 and 5). Approximately 20 cubic yards of contaminated sediment were removed from the cistern, and the cistern walls and floor were power washed.

Based on the information provided in the RAR, the contamination was enclosed within the cistern and was unlikely to have posed a threat to groundwater or migrated off-site. No COCs were identified for AOC M.

### **AOC N - Interior Dry Well**

A small dry well located under the floor of Building E was designated as AOC N (see Figure 4). The 18 inch wide and two feet deep well had brick walls and a clay bottom. According to former Mercer Rubber Company personnel who spoke with ELM, this well had not been used in over 30 years. Possible past use of the well was a receptacle for floor cleaning (washing and/or sweeping) wastes.

Two soil samples (one surface, one subsurface) were collected from the clay bottom and PID screened for VOCs; results were negative. Results of laboratory analysis of the surface sample indicated NJDEP Soil Criteria exceedances for metals (antimony, cadmium, copper, lead, zinc); PHC (21,000 mg/kg) also exceeded the NJDEP Soil Criteria (see Tables 4 and 5). With the exception of cadmium (7.1 mg/kg), results of laboratory analysis of the subsurface sample were below the NJDEP Soil Criteria. Approximately one and one half cubic yards of contaminated soil from the dry well was excavated (to a depth of three feet) and backfilled with clean soil.

Based on the information provided in the RAR, the contamination was limited to approximately one and one half foot depth in the dry well and was unlikely to have posed a threat to groundwater or migrated off-site. No COCs were identified for AOC N.

### **Underground and Above Ground Tank Removal**

The following UST and AST and were removed or closed in place at the Mercer Rubber site:

<b>Type</b>	<b>Capacity (gallons)</b>	<b>Use</b>	<b>Remedial Action Taken</b>
UST	2,000	Rubber cement	Closed in place
UST	550	Gasoline	Removed
UST	10,000	No. 4 fuel oil	Removed
AST	250	Fuel oil	Removed

Approximately 50 gallons of residual product was removed from the 2,000 gallon rubber cement UST (ELM 1994). Due to limited access, soil samples (7.5 feet depth) were collected by drilling four holes along the center line of the UST; results indicated the presence of VOCs and lead. Since contaminant concentrations were below New Jersey Soil Criteria (see Table 6), the UST was filled with sand and left in place. No residual was found in the 550 gallon gasoline UST. The UST was removed and upon inspection of its exterior, holes were observed along the bottom and about two feet of soil were excavated. Four soil samples collected from the excavation (i.e., two from the bottom and two from the sidewalls) were analyzed for VOCs and lead. Maximum concentrations of VOCs and lead detected were below the New Jersey Soil Criteria (see Table 6). Approximately 2,000 gallons of residual product and 36 inches of sludge were removed from the 10,000 gallon No. 4 fuel oil UST. Since the soil above and around the UST was observed to be stained, it was excavated. The UST was removed; an inspection of its exterior indicated that the UST was in good condition (no holes or visible stains). Stained soil was not observed in the excavation. Soil samples collected from the excavation were analyzed for PHCs and polycyclic aromatic hydrocarbons (PAHs). Results indicated PHC concentrations above the New Jersey Soil Criteria (see Tables 6). Contaminated soil was removed and the excavation was backfilled with certified clean fill.

Excavated soil from the gasoline and No. 4 fuel oil USTs were stockpiled on-site. Samples of these soils were collected and analyzed for VOCs, PAHs, lead, and PHCs. Maximum concentrations of lead, PHCs, and several PAHs from the No. 4 fuel oil excavation exceeded the New Jersey Soil Criteria (see Table 7). The contaminated soil was disposed off-site. No COCs were identified for the on-site area where USTs and AST were located.

### ***Groundwater***

The RAR reported that the Mercer Rubber Company utilized four on-site wells for plant operations (ELM 1995). Well logs obtained from the NJDEP, Bureau of Safe Drinking Water indicated that two of these wells were drilled in 1954 and 1957 at depths of 186 and 190 feet, respectively. The 1957 well was closed in 1992 (W. Hadsell, NJDEP, personal communication, 2005). Two older wells (140 foot depth) were also identified in the RAR; no information on well location (e.g., in the vicinity of any on-site processes or hazardous materials storage areas), construction details, and date or method of abandonment were available. In 1961, the Mercer Rubber Company was connected to the municipal water supply. No information is available on the use of on-site wells subsequent to 1961. As such, potential existed for aquifer contamination via these wells by on-site manufacturing operations.

### ***Ambient Air***

Emission factors for each of the unit processes associated with rubber product manufacturing (i.e., mixing, extrusion, calendaring, curing, grinding) have been determined using either mass balance calculations or direct measurement (USEPA 1999) (see Figure 6). Some of the volatile contaminants associated with these emission factors are known or suspected human carcinogens. Production records were unavailable for the Mercer Rubber Company. Efforts to obtain the NJDEP air permit for the company was unsuccessful; this documentation was retained for five years and destroyed (R. Esposito, NJDEP, personal communication, 2005). Therefore, specific VOC emissions from the plant could not be estimated.

Toxics Release Inventory (TRI) data on toluene, however, was available (USEPA 2005a).<sup>4</sup> For the years 1989 through 1992, the average annual toluene emission reported for the Mercer Rubber Company was about 10,000 pounds. A USEPA air dispersion model, (i.e., the Industrial Source Complex, ISCST3 model) was used to estimate ambient toluene concentrations at both on- and off-site locations. The ISCST3 is a steady-state Gaussian plume model which can be used to estimate contaminant concentrations from a wide variety of sources associated with an industrial complex (USEPA 2005b). This model takes into account a number of factors including the

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<sup>4</sup>The TRI is a publicly available USEPA database that contains information on toxic chemical releases and other waste management activities reported annually by certain industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990.

settling and dry deposition of particles, point, area, line, and volume sources, and limited terrain adjustment. ISCST3 inputs used for predicting toluene emissions from the former Mercer Rubber Company are provided below:

<b>Input Parameters Used in the ISCST3 Model*</b>	
Averaging time	24 hours
Release height	3 meters
Meteorological data	1/1/1991 - 12/31/1995 (Philadelphia Airport)
Modeled distance	100, 200, 300, 500, 800 and 1,000 meters

\*USEPA regulatory default parameters (USEPA 2005b)

The resulting 24-hour on-site maximum ambient concentration was estimated to be 160 micrograms of toluene per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ), below the ATSDR EMEG ( $300 \mu\text{g}/\text{m}^3$ ).

## **Off-Site Contamination**

### ***Groundwater***

According to a 1993 NJDEP well search, there were five private domestic, six public community supplies, and one groundwater monitoring wells located within a one mile radius of the Mercer Rubber Company site. Only one of the private domestic and four of the public community supply wells were in use at the time of the search (NJDEP 1993b). Although there were private domestic wells drawing from groundwater during manufacturing operations, no shallow groundwater sampling has been conducted to date.

The depth of the six public community supply wells ranged from 145 - 243 feet. These wells were located about one third of a mile to one mile from the Mercer Rubber Company site. The closest public well in relation to the site is located one-half mile west of the site and was active in 1993. Pursuant to New Jersey safe drinking water regulations, these wells are monitored on an annual basis. As far back as 1979, volatile organic scans were available for these wells and no contamination above state drinking water standards have been reported (P. Cohn, NJDHSS, personal communication, 2005).

In August 1998, the Hamilton Township Department of Water Pollution Control collected samples from four private residential wells located on Ziegler Lane and Paxson Avenue (NJDHSS 2000). Samples were analyzed for VOCs using USEPA Method 624; all results were reported as not detected.

### ***Ambient Air***

The ISCST3 model was used to estimate 24-hour off-site maximum toluene concentrations at distances ranging from 100 to 1,000 meters from the Mercer Rubber Company site; the results are provided in the following table. Estimated toluene concentrations for all distances were below the ATSDR EMEG (ATSDR 2000). It

should be noted that the years 1989 - 1992 may not be representative of either the average or peak manufacturing operations at the plant.

<b>Estimated Ambient Toluene Concentrations Associated with the former Mercer Rubber Company</b>		
<b>Distance from the plant (meters)</b>	<b>Concentrations (<math>\mu\text{g}/\text{m}^3</math>)</b>	
	<b>24-hour maximum</b>	<b>ATSDR EMEG<sup>1</sup></b>
100	100	300
200	46	
300	29	
500	14	
1,000	7	

<sup>1</sup>EMEGs are estimated contaminant concentrations that are not expected to result in adverse non-carcinogenic health effects.

The model was also used to calculate the annual average ambient concentrations of toluene in off-site areas. Concentration isopleths (i.e., lines connecting points of equal concentration) were plotted and presented in Figure 7. The ambient air concentration in the surrounding area ranged from about 0.1 - 16  $\mu\text{g}/\text{m}^3$ .

### ***Surface Soil***

No off-site surface soil sampling has been conducted to date.

### ***Surface Water***

No off-site surface water sampling has been conducted to date.

A brief discussion of the toxicologic characteristics of the COCs are presented in Appendix A.

## Discussion

The method for assessing whether a health hazard exists to a community is to determine whether there is a completed exposure pathway from a contaminant source to a receptor population and whether exposures to contamination are high enough to be of health concern. Site-specific exposure doses can be calculated and compared with health guideline CVs.

### Assessment Methodology

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at the interface with the human body. A completed exposure pathway consists of five elements:

1. source of contamination;
2. environmental media and transport mechanisms;
3. point of exposure;
4. route of exposure; and
5. receptor population.

Generally, the ATSDR considers three exposure pathway categories: 1) completed exposure pathways, that is, all five elements of a pathway are present; 2) potential exposure pathways, that is, one or more of the elements may not be present, but information is insufficient to eliminate or exclude the element; and 3) eliminated exposure pathways, that is, one or more of the elements is absent. Exposure pathways are used to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, present, and future.

#### *Completed Pathways*

Inhalation of ambient air (past). Based on TRI toluene data for the Mercer Rubber Company (see Figure 7) as well as generic VOC emission factors (see Figure 6) associated with the manufacture of rubber products, there was a completed exposure pathway via inhalation to area residents in the past. Besides toluene, other hazardous chemicals (e.g., benzene, 1,3-butadiene, acrylonitrile) were likely to have been emitted from the site during past rubber product manufacturing processes (see Table 1). Production records and air permit for the Mercer Rubber Company were unavailable, thus, specific VOC emissions could not be estimated for use in assessing off-site residential exposures. Ambient concentrations for these chemicals could not be modeled due to the lack of production records and air permits information.

#### *Potential Pathways*

Incidental ingestion of off-site surface soil (past, present, future). Interviewed former Mercer Rubber Company employees and/or long-time area residents indicated

that manufacturing process wastes (liquid and solid) were dumped off-site; the highest volume of this dumping reportedly occurred from the late 1960s through the early 1970s in the area to the north of the Sayen House. A NJDEP investigation also confirmed the presence of site-related dumped materials in this locale (NJDEP 1991). Area residents may have been exposed to these soils and exposures may have occurred. Since no off-site soil sampling was conducted, data are unavailable to assess this potential route of exposure.

Incidental ingestion of surface water (past, present, future). As stated above, it was reported that manufacturing waste products were dumped off-site. Liquid wastes were reportedly dumped in the unnamed creek, potentially contaminating surface water. Area residents may have been exposed to this surface water and exposures to contamination may have occurred through ingestion or dermal contact. Since no off-site surface water sampling was conducted, data are unavailable to assess this potential route of exposure.

Inhalation of contaminants in indoor air via vapor intrusion (past, present, future). Wastes (particularly liquid wastes) reportedly dumped in the unnamed creek may have contaminated the groundwater in the shallow aquifer. Additionally, VOCs in soil and groundwater can emit vapors that may migrate through subsurface soils and into indoor air spaces of overlying buildings. The vapor intrusion pathway may be important for buildings with or without a basement. Vapors can accumulate in occupied spaces to concentrations that may pose safety hazards, health effects, or aesthetic problems (e.g., odors). Since no groundwater sampling was conducted, data are unavailable to assess this potential route of exposure.

Ingestion of groundwater from private domestic wells (past). As mentioned earlier, wastes (particularly liquid wastes) reportedly dumped in the unnamed creek may have contaminated area groundwater. Results of a NJDEP 1993 well search indicated that there were five domestic wells located within one-half mile of the site, one of which was still active at the time of the search. The depth of these wells ranged from 64 - 159 feet. Since no groundwater sampling was conducted, data are unavailable to assess this potential route of exposure.

#### *Eliminated Pathways*

On-site soils. Based on the results of available environmental sampling data, the following are the on-site COCs associated with the Mercer Rubber Company site:

Media	VOCs	Metals
Soil	PCE	Lead Mercury

As discussed in the On-Site Contamination section, five AOCs had contaminant concentrations above NJDEP Soil Criteria and were remediated. Although maximum concentrations of PCE and lead detected in AOC C and mercury detected in AOC D

exceeded NJDEP RDCSCCs, subsequent soil excavation and grading activities during site development may have redistributed unremediated contaminants to levels below the NJDEP RDCSCC. As such, the NJDHSS determined that the potential for these contaminants to adversely impact on-site soils was unlikely.

Inhalation of ambient air (present, future). Manufacturing operations and emissions to ambient air at the Mercer Rubber Company ceased in 1993, hence, present and future exposures were eliminated.

Ingestion of groundwater from public community supply wells (past, present, future). According to a 1993 NJDEP well search, there are six public community supply wells located within one mile of the site; all but one were active at the time of the search. Pursuant to New Jersey safe drinking water regulations, these wells are monitored on an annual basis. As far back as 1979, volatile organic scans were available for these wells and no contamination above state drinking water standards have been reported. As such, past (to 1979), present, and future exposures were eliminated.

The exposure pathways for the Mercer Rubber Company site were also summarized in Table 8.

### **Public Health Implications**

In the past, ambient air was probably the most important exposure pathway for the Mercer Rubber Company site. Although the modeled off-site ambient air toluene concentration was determined to be below levels associated with non-cancer health effects, other VOCs associated with plant operations were probably emitted (see Tables 1 and 2). However, since no emissions data are available for these VOCs, public health implications associated with these contaminants could not be evaluated.

Benzene is classified by the United States Department of Health and Human Services as “known to be a human carcinogen” (USDHHS 2005). Epidemiological evidence from human occupational studies shows that long term exposure to benzene causes leukemia, particularly acute myelogenous leukemia (IARC 1987). Benzene exposure may also be associated with increased risk of chronic lymphocytic leukemia. 1,3-Butadiene is also classified as “known to be a human carcinogen” (USDHSS 2005). Human occupational studies show increased risk of leukemia, lymphosarcoma, and reticulosarcoma. Animal studies show that 1,3-butadiene can cause a variety of cancers. Acrylonitrile is classified as “reasonably anticipated to be a human carcinogen” based on evidence from experimental animal studies (USDHHS 2005). Exposure to acrylonitrile increased the occurrence of cancers of the stomach, central nervous system, breast, and other tissues. Human occupational studies suggest an increased risk of lung and prostate cancers.

In the rubber manufacturing industry, pre-1950s workers had a high risk of bladder cancer, probably from exposure to aromatic amines. Rubber industry workers

were also at higher risk of leukemias, most likely associated with exposure to solvents such as benzene (IARC 1987). Several other cancers have also been observed in excess in some occupational studies but not in others.

A separate health consultation evaluated the incidence of cancer in the neighborhoods surrounding the former Mercer Rubber Company site for the period 1979 - 2001 (ATSDR 2006). Overall, cancer incidence was not elevated in the area, in comparison to expected incidence based on statewide cancer rates. The incidence of brain and central nervous system cancer was statistically significantly higher than expected in females, but only slightly elevated in males. Bladder cancer was statistically significantly elevated in males, but slightly lower in females. Leukemia, a cancer type which is of particular concern from benzene and butadiene exposure, was slightly elevated in both males and females, but the differences from expected were not statistically significant. The incidence of breast cancer, of specific concern to the community, was not higher than expected in the neighborhoods surrounding the site. Although bladder cancer and (to a lesser degree) brain cancer have been associated with employment in the rubber industry, the inconsistency of findings between males and females does not indicate that environmental exposures in the community are responsible for these excesses.

### **Child Health Considerations**

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances because they eat and breathe more than adults (on a pound for pound basis). They also play outdoors and often bring food into contaminated areas. They are shorter than an adult, which means they breathe dust, soil, and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

The area surrounding the Mercer Rubber Company site is residential with wooded areas along the unnamed creek. Interviewed former Mercer Rubber Company employees and/or long-time area residents indicated that manufacturing process wastes (liquid and solid) were dumped off-site particularly in the area to the north of the Sayen House. The water of the unnamed creek was described as turning cloudy white from plant manufacturing process discharges. Community respondents reported either playing in the creek themselves or seeing children playing or fishing in the creek and the pond located just beyond Sayen Gardens. Off-site environmental sampling was not conducted, therefore, potential contaminant exposures to children cannot be determined at this time.

Although elevated concentrations of PCE, lead, and mercury were detected on-site during a 1993 site investigation, subsequent soil excavation and grading activities may have redistributed these contaminants to levels below health concern for current on-site residents.

## Conclusions

The Mercer Rubber Company operated from 1866 to 1993. Subsequent to plant closure in 1993, on-site AOCs were identified. These AOCs were remediated and/or the contamination was determined to be below NJDEP Soil Criteria. NFA letters were issued by the NJDEP in 1996 and 2000 and the site was later developed for residential housing. Based on a review of on-site soil contamination and remedial actions taken, there is “**No Apparent Public Health Hazard**” to the current residents of on-site homes.

During the manufacture of rubber products, pollutants from the company were released into the ambient air. This may have been the most important exposure pathway to area residents. Based on TRI toluene data and generic VOC emission factors associated with the manufacture of rubber products, it was determined that there was a completed exposure pathway via inhalation to area residents in the past. TRI data for the years 1989 - 1992 was used to model ambient toluene exposure concentrations which were found to be lower than levels likely to result in adverse health effects. Besides toluene, other hazardous chemicals (e.g., benzene, 1,3-butadiene, acrylonitrile) were likely to have been emitted from the site. Ambient concentrations for these chemicals could not be modeled due to the lack of production records and air permit information.

A review of cancer incidence data for the neighborhoods surrounding the former Mercer Rubber site showed no overall excess. Bladder cancer was statistically significantly elevated in males, and brain and central nervous system cancer was statistically significantly elevated in females. Leukemia was slightly elevated in both males and females, but the differences from expected were not statistically significant. Breast cancer, also of concern to the community, was not elevated. The analysis provided little evidence that cancer incidence in the area was affected by environmental exposures associated with the Mercer Rubber site.

In addition to the ambient air exposure pathway, manufacturing processes and on- and off-site disposal practices may have contaminated area soil, surface water, and groundwater. Off-site environmental sampling of soil, surface water, and private domestic wells was not conducted, so environmental data were not available to assess potential exposure pathways. As such, past, present, and future off-site exposures represent an “**Indeterminate Public Health Hazard**”. Environmental sampling can be used to evaluate possible current site-related exposures.

Manufacturing operations and emissions to ambient air at the Mercer Rubber Company ceased in 1993, hence, present and future exposures via this pathway were eliminated.

## **Recommendations**

1. The NJDEP should sample soils in off-site areas where Mercer Rubber Company wastes were allegedly dumped.
2. To assist in evaluating the potential for vapor intrusion of contaminants into residential homes, the NJDEP should sample area shallow groundwater.
3. The results of a well search by the NJDEP indicated that one private domestic well was active as of 1993. As such, the NJDEP should determine if this well is being used for household purposes.

## **Public Health Action Plan**

The Public Health Action Plan (PHAP) for the former Mercer Rubber Company site contains a description of the actions to be taken by the NJDHSS and/or ATSDR at or in the vicinity of the site subsequent to the completion of this Public Health Assessment. The purpose of the PHAP is to ensure that this health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of the NJDHSS and ATSDR to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by NJDHSS and ATSDR are as follows:

### **Public Health Actions Taken**

1. Available environmental data and other relevant information for the former Mercer Rubber Company site have been reviewed and evaluated to determine human exposure pathways and public health issues.
2. In cooperation with the ATSDR, NJDEP, and Hamilton Township Department of Health, several site visits were conducted of the Mercer Rubber Company site.
3. The NJDHSS met with the petitioner on several occasions to discuss concerns and obtain former employee and/or long-time area resident contact information.
4. The NJDHSS evaluated health outcome data in a separate health consultation.

### **Public Health Actions Planned**

1. The NJDHSS will prepare a Citizen's Guide for the Mercer Rubber site which will be made available to residents, the Hamilton Township Department of Health, and local repositories.

2. In cooperation with the ATSDR, the NJDHSS will schedule an availability session with area residents to discuss the findings of the public health assessment and health consultation.
3. The NJDHSS will reevaluate public health implications of the site when additional environmental data become available from the NJDEP.

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**Preparers of Report:**

Julie R. Petix, MPH, CPM, HO  
Research Scientist I  
New Jersey Department of Health and Senior Services

Tariq Ahmed, PhD, PE, DEE  
Research Scientist II  
New Jersey Department of Health and Senior Services

Steven M. Miller, PhD  
Environmental Scientist II  
New Jersey Department of Health and Senior Services

Somia Aluwalia, PhD  
Research Scientist II  
New Jersey Department of Health and Senior Services

**ATSDR Regional Representatives:**

Arthur Block  
Senior Regional Representative

Leah T. Escobar, R.S.  
Associate Regional Representative

**ATSDR Technical Project Officer:**

Gregory V. Ulirsch, MS, PhD  
Technical Project Officer  
Superfund Site Assessment Branch  
Division of Health Assessment and Consultation

**Any questions concerning this document should be directed to:**

Hazardous Site Health Evaluation Program  
Consumer and Environmental Health Services  
New Jersey Department of Health and Senior Services  
3635 Quakerbridge Road  
P.O. Box 369  
Trenton, New Jersey 08625-0369  
(609) 584-5367

## **CERTIFICATION**

The health consultation for the Mercer Rubber Company site, Mercer County, New Jersey was prepared by the New Jersey Department of Health and Senior Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

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Gregory V. Ulirsch, MS, PhD  
Technical Project Officer, CAT, SPAB, DHAC  
Agency for Toxic Substances and Disease Registry

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

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Alan Yarbrough  
Team Leader, CAT, SPAB, DHAC  
Agency for Toxic Substances and Disease Registry

**Table 1: Common Air Emissions from Rubber Product Manufacturing Processes (USEPA 1999)**

Activity	Air Emissions
<p><b>Process Operations</b></p> <ul style="list-style-type: none"> <li>• Mixing</li> <li>• Milling</li> <li>• Extrusion</li> <li>• Calendering</li> <li>• Curing</li> <li>• Grinding</li> <li>• Wastewater treatment</li> <li>• Unloading and loading of raw materials and products</li> </ul> <p><b>Combustion Processes</b></p> <ul style="list-style-type: none"> <li>• On-site energy/heat/steam production using oil/gas/coal</li> <li>• Gas flaring</li> </ul>	<ul style="list-style-type: none"> <li>• Acetaldehyde</li> <li>• Acetonitrile</li> <li>• Acrylonitrile</li> <li>• Benzene</li> <li>• Biphenyl</li> <li>• 1,3-Butadiene</li> <li>• Cadmium &amp; compounds</li> <li>• Carbon Disulfide</li> <li>• Chloroethane</li> <li>• Chloroform</li> <li>• Chromium (III) compounds</li> <li>• Chromium (VI) compounds</li> <li>• Cobalt &amp; compounds</li> <li>• Cumene</li> <li>• 1,2-Dichloroethane</li> <li>• Dibutyl Phthalate</li> <li>• 1,2-Dibromoethane</li> <li>• Ethylbenzene</li> <li>• Carbon Monoxide</li> <li>• Fluoride Compounds</li> <li>• Hydrochloric Acid</li> <li>• Oxides of Nitrogen</li> <li>• Particulate Matter (PM10)</li> <li>• Polycyclic Aromatic Hydrocarbons</li> <li>• Sulfur Dioxide</li> <li>• Total Volatile Organic Compounds</li> <li>• Arsenic &amp; compounds</li> <li>• Beryllium &amp; compounds</li> <li>• Cadmium &amp; compounds</li> <li>• n-Hexane</li> <li>• Lead &amp; compounds</li> <li>• Methyl Methacrylate</li> <li>• 4,4-Methylene bis 2,4 aniline (MOCA)</li> <li>• Methyl Ethyl Ketone</li> <li>• Methyl Isobutyl Ketone</li> <li>• Nickel &amp; compounds</li> <li>• Particulates (PM10)</li> <li>• Phenol</li> <li>• Styrene</li> <li>• 1,1,1,2-Tetrachloroethane</li> <li>• Tetrachloroethylene</li> <li>• 1,1,2-Trichloroethane</li> <li>• Chlorophenols</li> <li>• Toluene</li> <li>• Vinyl Chloride</li> <li>• Xylenes</li> <li>• Chromium (III) compounds</li> <li>• Chromium (VI) compounds</li> <li>• Copper &amp; compounds</li> <li>• Lead &amp; compounds</li> <li>• Magnesium Oxide Fume</li> <li>• Manganese &amp; compounds</li> <li>• Mercury &amp; compounds</li> <li>• Nickel &amp; compounds</li> <li>• Nickel Carbonyl</li> <li>• Nickel Subsulfide</li> </ul>

**Table 2: Mercer Rubber Company Right-To-Know Compound Inventory**

<b>Compound</b>	<b>Years Reported</b>	<b>Container Type</b>	<b>Location</b>	<b>Averaged Daily Inventory (lbs)</b>
“Rubber Solution”	1991	Steel drums	Outdoor storage	1,450
Acrylonitrile	1991	Box	Not specified	9
Benzene	1988	Steel drums	Outdoor Flammable liquid storage area	101 – 1,000
Butadiene	1991	Box (cylinders)	Not specified	24
Carbon black	1988, 1991	Unknown	Mill Room	16,500
Dry polychloroprene	1991	Box	Mill Room	8,000
Ethylene thiourea	1991	Unknown	Mill Room	50
Fuel oil	1991	Unknown	Side of building	40,000
Gasoline	1991	Steel drums	Outdoor storage	200
Heavy paraffinic distillate solvent extract	1991	Unknown	Mill Room	70
Methyl ethyl ketone	1988, 1991	Unknown	Outdoor Flammable liquid storage area	50
Propane	1988, 1991	Propane tank	Storage in back of shop	40
Toluene	1988, 1991, 1992	Steel drums	Outdoor storage	1,450

**Table 3: Summary of Field and Analytical Results for Potential Areas of Concern at the Mercer Rubber Company Site**

Potential Area of Concern	Number of Samples	PID Field Screening Result (ppm)	Results Above NJDEP Soil Criteria					Remediated
			PHC	VOC	SVOC	Metals	PCBs	
A - Open Paved Area	9	< 2 to 5	No Exceedances					NA <sup>a</sup>
B - Open Grass Covered Area	5	< 1	No Exceedances					NA
C - Former Drum Storage Area	11	< 1 to >1,000	No	Yes	Yes	Yes	NT <sup>b</sup>	No
D - Former Storage Area	5	< 1 to 3	Yes	No	Yes	Yes	NT	No
F - Former Outside Pit	6	< 2	Yes	NT	NT	NT	NT	Yes
G - Boiler Blowdown Pits	5	0 to < 1	Yes	No	Yes	NT	NT	Yes
H - Former Transformers	7	NT	NT	NT	NT	NT	Yes	Yes
I - Former Dust Collector	2	< 1	No	No	No	Yes	NT	No
J - Power House	2	< 1	No Exceedances					NA

**Table 3: (Cont'd.)**

Potential Area of Concern	Number of Samples	PID Field Screening Result (ppm)	Results Above NJDEP Soil Criteria					Remediated
			PHC	VOC	SVOC	Metals	PCBs	
L - Former Machine Pit Earthen Floor	2	< 1	No Exceedances					NA
M - Interior Cistern	2	0	Yes	NT	Yes	Yes	NT	Yes
N - Interior Dry Well	2	0	Yes	NT	NT	Yes	NT	Yes

<sup>a</sup>not applicable<sup>a</sup>not tested

**Table 4: Maximum contaminant concentrations detected in soil samples from various AOCs<sup>a</sup> at the Mercer Rubber Company site**

Contaminants	Maximum concentration in Area of Concern (mg/kg)								RDCSCC (mg/kg)	Environmental CV (mg/kg)	COC
	C	D	F	G	H	I	M	N			
Volatile Organic Compounds											
Acetone	3.4 <sup>b</sup>	ND <sup>c</sup>	ND	0.16 <sup>d</sup>	ND	ND	ND	ND	1,000	7,800 (RBC <sup>e</sup> )	no
Benzene	0.27 <sup>b</sup> (J)	ND	ND	ND	ND	ND	ND	ND	3	10 (CREG <sup>f</sup> )	no
1,1-Dichloroethane	12 <sup>b</sup>	ND	ND	ND	ND	ND	ND	ND	570	7,800 (RBC)	no
Ethylbenzene	2.7 <sup>b</sup>	ND	ND	ND	ND	ND	ND	ND	1,000	5,000 (RMEG <sup>g</sup> )	no
Methylene Chloride	0.44 <sup>b</sup> (J)	0.008	0.005 <sup>d</sup> (J)	0.009 <sup>d</sup>	ND	0.024	ND	ND	49	90 (CREG)	no
Tetrachloroethene	5.6 <sup>b</sup>	ND	ND	ND	ND	ND	ND	ND	4	500 (RMEG)	yes
Toluene	1.7 <sup>b</sup>	ND	ND	0.027 <sup>d</sup>	ND	0.022	ND	ND	1,000	1,000 (EMEG <sup>h</sup> )	no
Trichloroethene	0.51 <sup>b</sup> (J)	ND	ND	ND	ND	ND	ND	ND	23	7.2 (RBC)	no
1,1,1-Trichloroethane	13 <sup>b</sup>	ND	ND	ND	ND	ND	ND	ND	210	22,000 (RBC)	no
Xylenes (total)	15 <sup>b</sup>	ND	ND	0.008 <sup>d</sup>	ND	ND	ND	ND	410	10,000 (RMEG)	no
1,3-Dichlorobenzene	ND	ND	ND	3.81 <sup>d</sup> (J)	ND	ND	ND	ND	5,100	31,000 (RBC)	no
2,4-Dimethylphenol	0.18 (J)	ND	ND	ND	ND	ND	ND	ND	1,100	1,000 (RMEG)	no
1,2,4-Trichlorobenzene	ND	ND	ND	3.9 <sup>d</sup> (J)	ND	ND	ND	ND	68	500 (RMEG)	no
Semi Volatile Organic Compounds											
Acenaphthene	0.18 (J)	ND	ND	8.18 <sup>b</sup> (J)	ND	0.047 (J)	ND	ND	3,400	1,000 (EMEG)	no
Acenaphthylene	0.11 (J)	ND	ND	ND	ND	0.17 (J)	ND	ND	NA <sup>i</sup>	NA	no
Anthracene	0.31 (J)	1.8 (J)	ND	2.01 <sup>b</sup> (J)	ND	0.29 (J)	ND	ND	10,000	20,000 (EMEG)	no

**Table 4: (Cont'd.)**

Contaminants	Maximum concentration in Area of Concern (mg/kg)								RDCSCC (mg/kg)	Environmental CV (mg/kg)	COC
	C	D	F	G	H	I	M	N			
Semi-Volatile Organic Compounds											
Benzo[a]anthracene	0.92	ND	0.62 <sup>a</sup> (J)	2.26 <sup>b</sup> (J)	ND	1.1	ND	ND	0.9	3.9 (RBC)	no
Benzo[a]pyrene	0.76	ND	ND	ND	ND	1.1	ND	ND	0.66	0.1 (CREG)	no
Benzo[b]fluoranthene	1	ND	ND	1.94 <sup>b</sup> (J)	ND	1.4	ND	ND	0.9	3.9 (RBC)	no
Benzo[g,h,i]perylene	0.32 (J)	ND	ND	ND	ND	0.36 (J)	ND	ND	NA	NA	no
Benzo[k]fluoranthene	0.9	ND	ND	ND	ND	1.1	ND	ND	0.9	8.7 (RBC)	no
Chrysene	1.4	ND	0.78 <sup>a</sup> (J)	2.13 <sup>b</sup> (J)	ND	1.7	ND	ND	9	87 (RBC)	no
Dibenz[a,h]anthracene	0.2 (J)	ND	ND	ND	ND	0.28 (J)	ND	ND	0.66	0.087 (RBC)	no
Fluoranthene	2.2	ND	ND	6.31 <sup>d</sup> (J)	ND	2.1	ND	ND	2,300	800 (EMEG)	no
Fluorene	0.23 (J)	0.73 (J)	ND	3.33 <sup>d</sup> (J)	ND	0.048	ND	ND	2,300	800 (EMEG)	no
Pyrene	1.9	1.9 (J)	2 <sup>a</sup> (J)	10.3 <sup>d</sup>	ND	1.7	ND	ND	1,700	2,000 (RMEG)	no
bis(2-Ethylhexyl)phthalate	0.15 (J)	43	21 <sup>a</sup>	21 <sup>d</sup>	ND	0.049 (J)	318 <sup>b</sup>	1.87 <sup>c</sup> (J)	49	50 (CREG)	no
INDeno[1,2,3-cd]pyrene	0.35 (J)	ND	ND	ND	ND	ND	ND	ND	0.9	3.9 (RBC)	no
Carbazole	0.14 (J)	ND	ND	ND	ND	0.092 (J)	ND	ND	NA	32 (RBC)	no
Dibenzofuran	0.15 (J)	ND	ND	ND	ND	0.054 (J)	ND	ND	NA	160 (RBC)	no
Di-n-butylphthalate	0.26 (J)	ND	ND	ND	ND	ND	ND	ND	5,700	5,000 (RMEG)	no
Di-n-octylphthalate	ND	ND	ND	0.6 <sup>d</sup> (J)	ND	ND	ND	ND	1,100	800 (EMEG)	no
2-Methylnaphthalene	0.25 (J)	ND	ND	ND	ND	ND	ND	ND	NA	1,600 (RBC)	no
2-Methylphenol	2.4	ND	ND	ND	ND	ND	ND	ND	2,800	3,900 (RBC)	no

**Table 4: (Cont'd.)**

Table 4: (Cont'd.)

Contaminants	Maximum concentration in Area of Concern (mg/kg)								RDCSCC (mg/kg)	Environmental CV (mg/kg)	COC
	C	D	F	G	H	I	M	N			
Semivolatile Organic Compounds											
4-Methylphenol	3.6	ND	ND	ND	ND	ND	ND	ND	2,800	3,900 (RBC)	No
Naphthalene	0.14 (J)	8.7 (J)	ND	4.7 <sup>d</sup> (J)	ND	ND	ND	ND	230	40 (EMEG)	no
Phenanthrene	2.3	ND		8.72 <sup>d</sup> (J)	ND	1.1	ND	ND	NA	NA	no
Aroclor-1260 (PCBs)	ND	ND	ND	ND	11	0.02 (J)	ND	ND	0.49	1.4 (RBC)	no
Petroleum Hydrocarbons (PHC)	800	73,000	130,000 <sup>a</sup>	72,700 <sup>d</sup>	2,100	68	576,000 <sup>d</sup>	21,000 <sup>d</sup>	10,000	NA	no

<sup>a</sup>AOCs in shaded columns are remediated; <sup>b</sup>1.5 - 2.0 feet depth; <sup>c</sup>not detected; <sup>d</sup>>8 feet depth; EPA Region 3 Risk-Based Concentration; <sup>i</sup>ATSDR Cancer Risk Evaluation Guide; <sup>g</sup>ATSDR Reference Media Evaluation Guide; <sup>h</sup>Environmental Media Evaluation Guide; <sup>i</sup>not available

**Table 5: Maximum metal concentrations detected in soil samples<sup>a</sup> (mg/kg) at the Mercer Rubber Company site**

Metals	Area of Concern					RDCSCC (mg/kg)	Environmental Guideline CV (mg/kg)	COC
	C	D	I	M	N			
Aluminum	8,350	16,000	4,780	4,490 <sup>b</sup>	7,600 <sup>b</sup>	NA <sup>c</sup>	100,000 (EMEG <sup>d</sup> )	no
Antimony	ND	ND	ND	17 <sup>b</sup> (J)	<b>340<sup>b</sup></b>	14	20 (RMEG <sup>e</sup> )	no
Arsenic	9.6	7	8.5	8.7 <sup>b</sup>	19 <sup>b</sup>	20	20 (EMEG)	no
Barium	237	92.6	186	48 <sup>b</sup>	284 <sup>b</sup>	700	5,500 (RBC <sup>f</sup> )	no
Beryllium	ND	ND	ND	0.98 <sup>b</sup>	0.48 <sup>b</sup>	1	100 (EMEG)	no
Cadmium	ND	<b>4</b>	<b>1.4</b>	NA	<b>7.1<sup>b</sup></b>	39	10 (EMEG)	no
Chromium	10.3	19.6	7	47 <sup>b</sup>	95 <sup>b</sup>	240	200 (RMEG)	no
Cobalt	ND	ND	6.2	14 <sup>b</sup>	25 <sup>b</sup>	NA	500 (EMEG)	no
Copper	24.6	34.8	47.8	699 <sup>b</sup>	<b>1,540<sup>b</sup></b>	600	60 (EMEG)	no
Lead	<b>1,020</b>	137	229	<b>1,200<sup>b</sup></b>	<b>3,860<sup>b</sup></b>	400	NA	<b>yes</b>
Magnesium	1,360	2,020	1,950	8,430 <sup>b</sup>	25,900 <sup>b</sup>	NA	NA	no
Manganese	72.2	349	110	110 <sup>b</sup>	344 <sup>b</sup>	NA	1,600 (RBC)	no
Mercury	1.3	<b>26.9</b>	0.3	0.12 <sup>b</sup> (J)	0.57 <sup>b</sup>	14	NA	<b>yes</b>
Nickel	12.8	13	14.2	120 <sup>b</sup>	230 <sup>b</sup>	250	1,000 (RMEG)	no
Selenium	0.67	ND	0.8	0.32 <sup>b</sup> (J)	0.75 <sup>b</sup> (J)	63	300 (RMEG)	no
Silver	ND	ND	ND	0.97 <sup>b</sup> (J)	1.4 <sup>b</sup>	110	300 (RMEG)	no
Vanadium	16.9	31.4	32.6	100 <sup>b</sup>	18 <sup>b</sup>	370	200 (EMEG)	no
Zinc	555	533	1,130	677 <sup>b</sup>	<b>5,060<sup>b</sup></b>	1,500	600 (EMEG)	no

<sup>a</sup>AOCs in shaded columns are remediated; <sup>b</sup>>8 feet depth; <sup>c</sup>not available; <sup>d</sup>ATSDR Reference Media Evaluation Guide; <sup>e</sup>Environmental Media Evaluation Guide;

<sup>f</sup>EPA Region 3 Risk-Based Concentration

**Table 6: Contaminants found in soil samples (mg/kg) during Mercer Rubber Company UST closure/removal operations<sup>a</sup>**

Contaminant	Gasoline UST (6 feet)		Rubber Cement UST (7.5 feet)		Fuel Oil Tank UST (> 8 feet)		RDCSCC <sup>b</sup>	Environmental CV (mg/kg)	COC
	Range	Mean	Range	Mean	Range	Mean			
Volatile Organic Compounds									
Acetone	0.005 - 0.01	0.0075	0.002 - 0.025	0.0078	NT <sup>c</sup>	NT	1,000	7,800 (RBC <sup>d</sup> )	no
Methylene Chloride	ND <sup>e</sup>	ND	0.001	0.00063	NT	NT	49	90 (CREG <sup>f</sup> )	no
1,1,2,2-Tetrachloroethane	ND	ND	0.001	0.00063	NT	NT	34	3.2 (RBC)	no
Total Xylenes	0.001 - 0.003	0.002	0.001 - 0.006	0.0004	NT	NT	410	10,000 (RMEG <sup>g</sup> )	no
2-Butanone	0.001 - 0.002	0.0012	0.001 - 0.003	0.0011	NT	NT	NA	4,700 (RBC)	no
Semivolatile Organic Compounds									
Acenaphthene	NT	NT	NT	NT	0.02 - 0.73	0.15	NA	NA	no
Anthracene	NT	NT	NT	NT	0.02 - 0.51	0.12	10,000	20,000 (EMEG <sup>h</sup> )	no
Benzo[a]anthracene	NT	NT	NT	NT	0.015 - 0.1	0.06	0.66	3.9 (RBC)	no
Chrysene	NT	NT	NT	NT	0.01 - 0.13	0.05	9	87 (RBC)	no
Fluoranthene	NT	NT	NT	NT	0.015 - 0.58	0.125	2,300	800 (EMEG)	no
Phenanthrene	NT	NT	NT	NT	0.15 - 4.1	1.05	NA	NA	no
Pyrene	NT	NT	NT	NT	0.01 - 0.42	0.12	1,700	2,000 (RMEG)	no
Metals									
Lead	10 - 22	14.75	16 - 33	22.5	NT	NT	400	NA	no
Petroleum Hydrocarbons	NT	NT	NT	NT	32 - 12,000	3,868	10,000	NA	no

<sup>a</sup>Excavated soil in shaded columns are remediated; <sup>b</sup>NJDEP Residential Direct Contact Soil Cleanup Criteria; <sup>c</sup>not tested; <sup>d</sup>EPA Region 3 Risk-Based Concentration; <sup>e</sup>not detected; <sup>f</sup>ATSDR Cancer Risk Evaluation Guide; <sup>g</sup>ATSDR Reference Media Evaluation Guide; <sup>h</sup>ATSDR Environmental Media Evaluation Guide

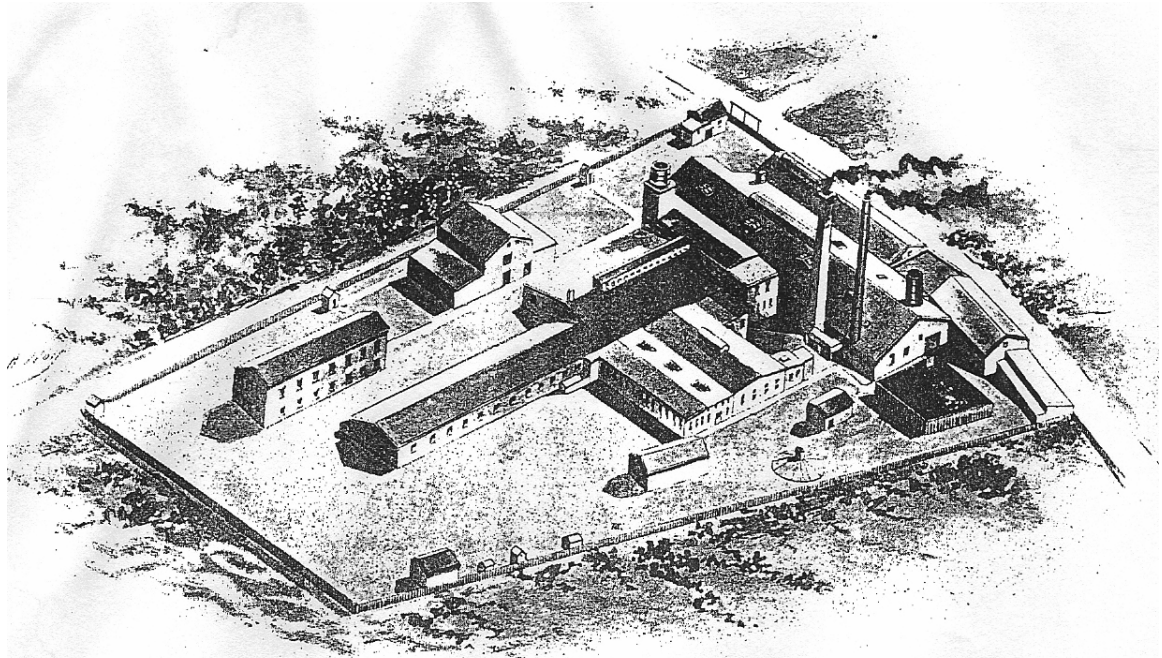
**Table 7: Sample results (mg/kg) from stockpiled soil from Mercer Rubber Company UST closure/removal<sup>a</sup>**

Contaminant	Gasoline UST		No. 4 Fuel Oil UST		RDCSCC <sup>b</sup>	Environmental Guideline CV (mg/kg)	COC
	Range	Mean	Range	Mean			
Semi Volatile Organic Compounds							
Acenaphthylene	NT <sup>c</sup>	NT	0.09 - 0.58	0.455	NA <sup>d</sup>	NA	no
Anthracene	NT	NT	0.12 - 0.6	0.39	10,000	20,000 (EMEG <sup>e</sup> )	no
Benzo[a]anthracene	NT	NT	1.9 - 2.1	1.17	0.9	3.9 (RBC <sup>f</sup> )	no
Benzo[a]pyrene	NT	NT	<b>0.2 - 2.2</b>	<b>0.98</b>	0.66	0.1 (CREG <sup>g</sup> )	no
Benzo[a]fluoranthene	NT	NT	<b>0.39 - 2.6</b>	<b>1.26</b>	0.9	3.9 (RBC)	no
Benzo[k]fluoranthene	NT	NT	0.3 - 0.8	0.55	0.9	8.7 (RBC)	no
Benzo[g,h,i]perylene	NT	NT	0.39 - 1.4	0.82	NA	NA	no
Chrysene	NT	NT	0.73 - 2.2	1.32	9	87 (RBC)	no
Dibenz[a,h]anthracene	NT	NT	<b>0.2 - 0.73</b>	0.39	0.66	87 (RBC)	no
Fluoranthene	NT	NT	0.47 - 4.2	1.99	2,300	800 (EMEG)	no
Fluorene	NT	NT	0.38 - 1.9	0.45	2,300	800 (EMEG)	no
Indeno[1,2,3-cd]pyrene	NT	NT	<b>0.33 - 1.5</b>	0.76	0.9	3.9 (RBC)	no
Naphthalene	NT	NT	0.61	0.23	230	40 (EMEG)	no
Phenanthrene	NT	NT	3.3	1.59	NA	NA	no
Pyrene	NT	NT	4.7	2.9	1,700	2,000 (RMEG <sup>h</sup> )	no
Metals							
Lead	23	23	<b>470</b>	288	400	NA	no
Petroleum Hydrocarbons	NT	NT	<b>28,000</b>	8,260	10,000	NA	no

<sup>a</sup>Excavated soil in shaded columns were remediated; <sup>b</sup>NJDEP Residential Direct Contact Soil Cleanup Criteria; <sup>c</sup>not tested; <sup>d</sup>not detected; <sup>e</sup>ATSDR Environmental Media Evaluation Guide; <sup>f</sup>EPA Region 3 Risk-Based Concentration; <sup>g</sup>ATSDR Cancer Risk Evaluation Guide; <sup>h</sup>ATSDR Reference Media Evaluation Guide

**Table 8: Exposure Pathways Associated with the Mercer Rubber Company Site**

<b>Medium</b>	<b>Point of Exposure</b>	<b>Route of Exposure</b>	<b>Receptor Population</b>	<b>Pathway Classification</b>
<b>Ambient air</b>	<b>Air</b>	<b>Inhalation</b>	<b>Local Residents</b>	<b>Past - Completed Present/Future - Eliminated</b>
<b>Surface soil</b>	<b>Off-site waste disposal areas (along unnamed creek, Sayen Gardens)</b>	<b>Ingestion, dermal</b>		<b>Past/Present/Future - Potential</b>
<b>Surface water</b>	<b>Unnamed creek, pond, site runoff</b>	<b>Ingestion, dermal</b>		
<b>Groundwater (shallow aquifer)</b>	<b>Residences</b>	<b>Ingestion, Inhalation (vapor intrusion)</b>		
<b>Groundwater (deep aquifer)</b>	<b>Residences, tap</b>	<b>Ingestion, inhalation, dermal</b>		<b>Past/Present/Future - Eliminated</b>



## MERCER RUBBER COMPANY.

INCORPORATED 1870.

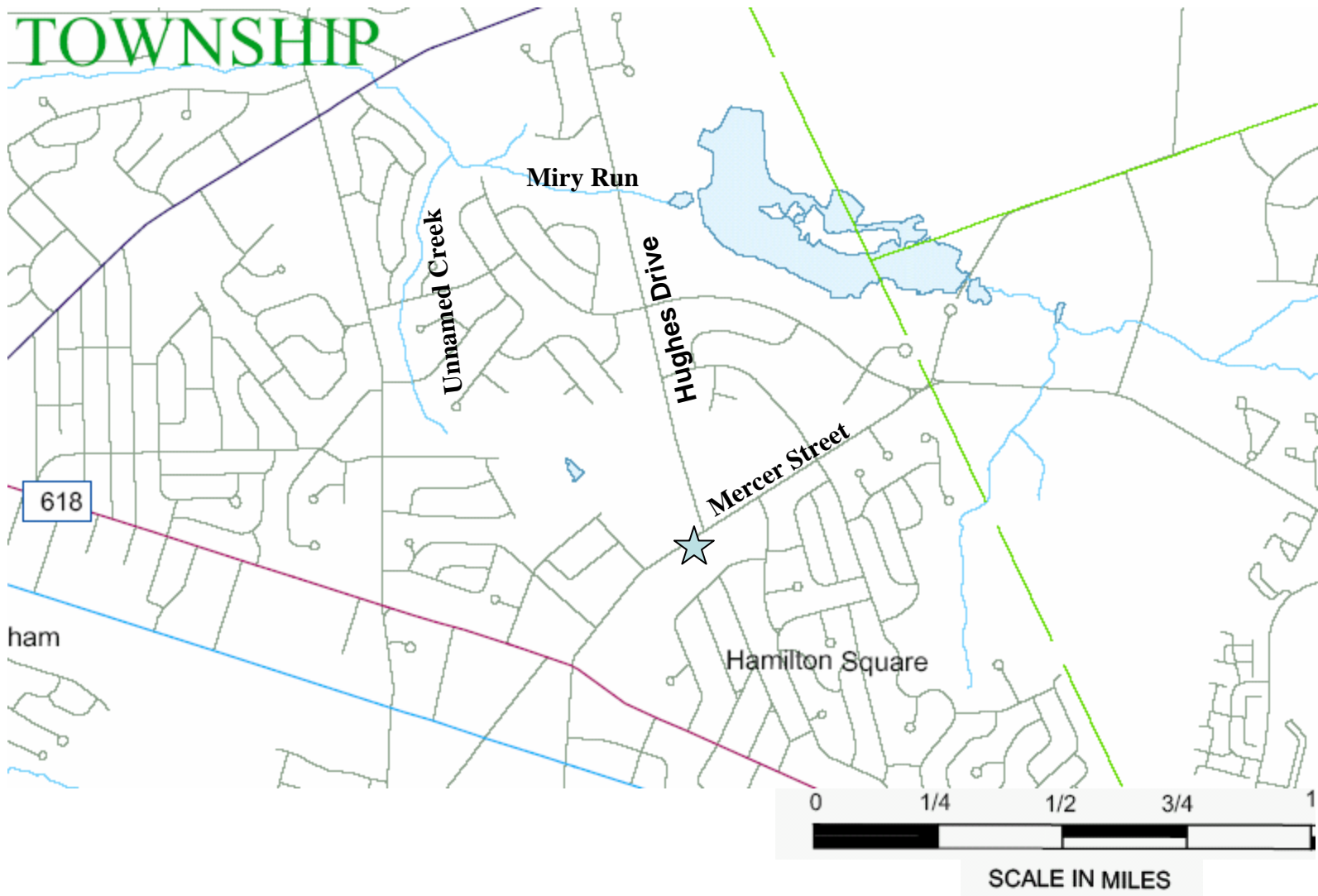
P. O. Address, Trenton, N. J.

Works at Hamilton Square, N. J.

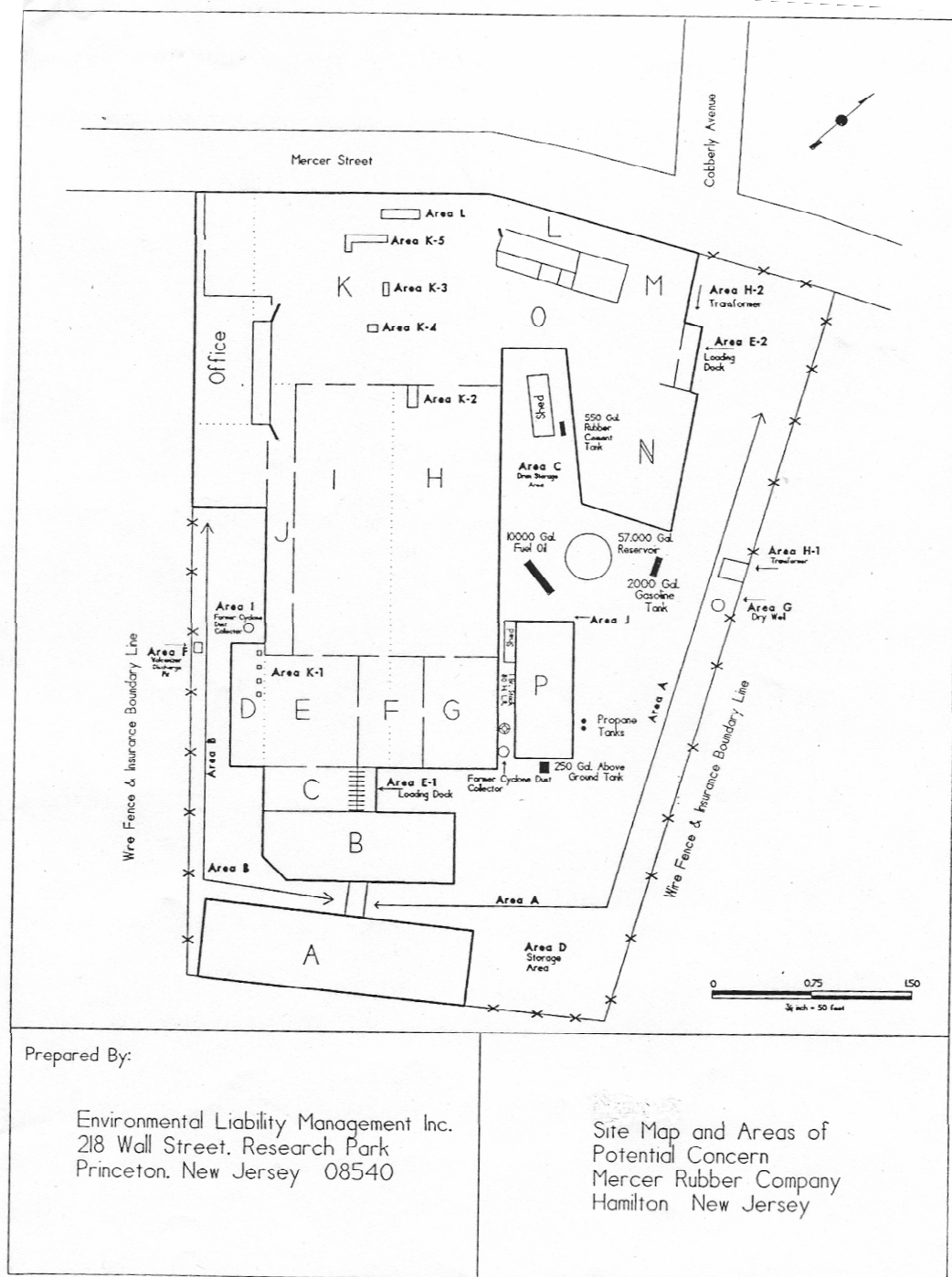
MANUFACTURERS OF RUBBER GOODS FOR MECHANICAL PURPOSES.

Makers of the highest grades of Pure Para Belting, Pure Para Steam, Fire, Suction, Water and Air Brake Hose. Our duck is woven expressly for these goods, and time guarantees given with branded dates. We also make a specialty of Valves, Fruit Jar Rings, Pure Gum, Cord, Perforated Mats and Matting. Our Garnet Sheet Packing is unsurpassed by anything on the market—soft and tenacious—compound not affected by heat. Tubing, Wringer Rolls, C. I. Gaskets and Rings of all kinds. Kindly write for catalogue.

**Figure 2: Sketch of the former Mercer Rubber Company (date unknown)**



**Figure 3: Location of Mercer Rubber Company site**



# Mercer Rubber Company

## Hamilton Square, New Jersey

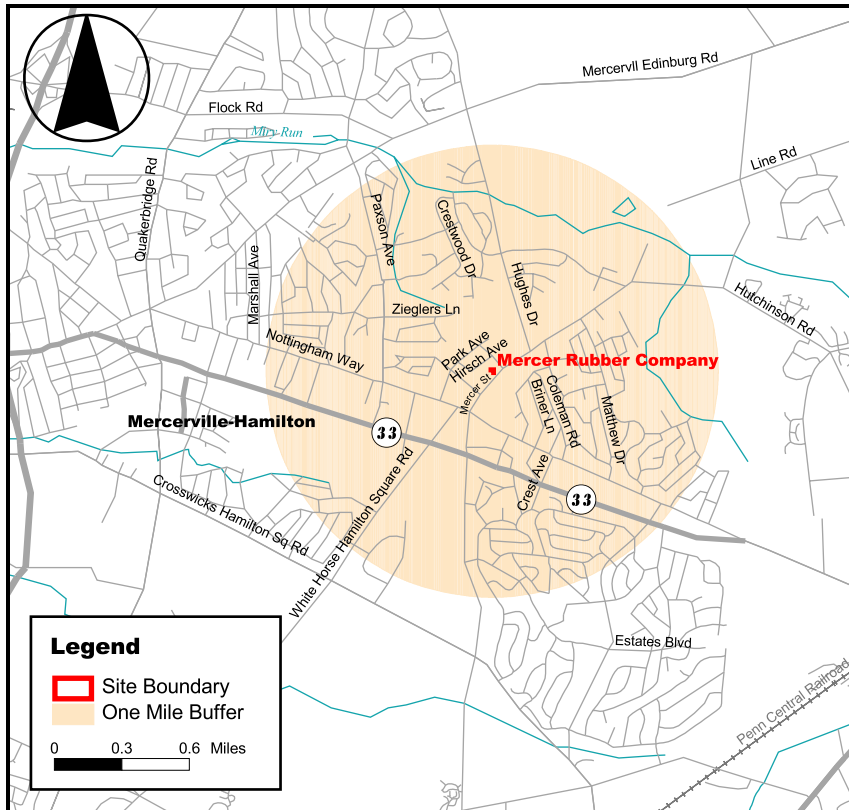
EPA Facility ID NJD002328961

# INTRO MAP

Site Location



## Mercer County, New Jersey



Base Map Source: 1995 TIGER/Line Files

## Demographic Statistics Within Area of Concern\*

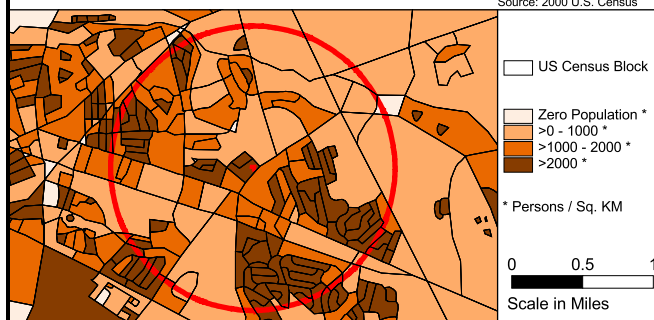
	0.5mi	1mi
Total Population	2893	10648
White alone	2778	10123
Black alone	15	91
Am. Indian & Alaska Native alone	5	13
Asian alone	51	264
Native Hawaiian and Other Pacific Islander alone	1	2
Some other race alone	20	61
Two or More races	24	98
Hispanic or Latino	58	245
Children Aged 6 & Younger	248	919
Adults Aged 65 & Older	483	1736
Females Aged 15 - 44	572	2038
Total Housing Units	1107	3765

Demographics Statistics Source: 2000 U.S. Census

\*Calculated using an area-proportion spatial analysis technique

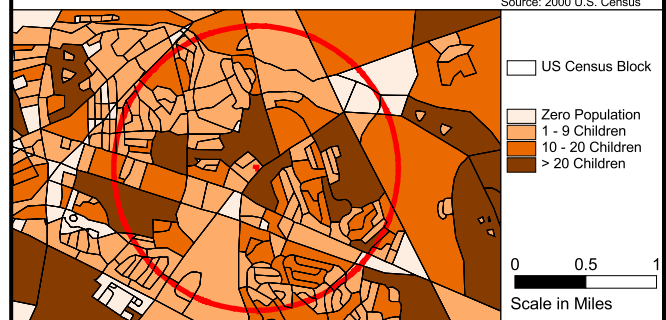
## Population Density

Source: 2000 U.S. Census



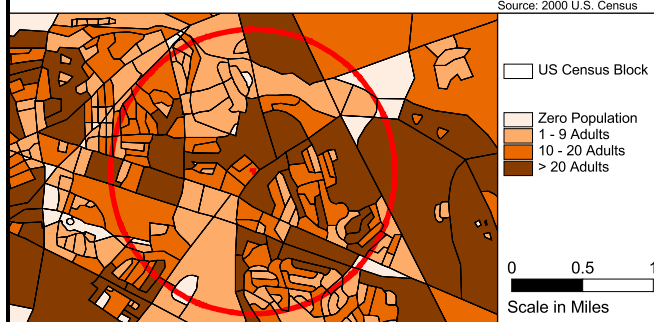
## Children 6 Years and Younger

Source: 2000 U.S. Census



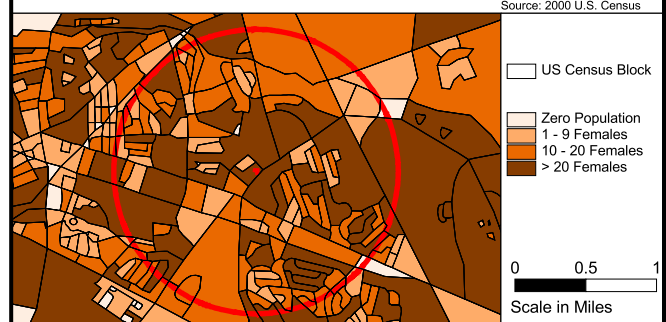
## Adults 65 Years and Older

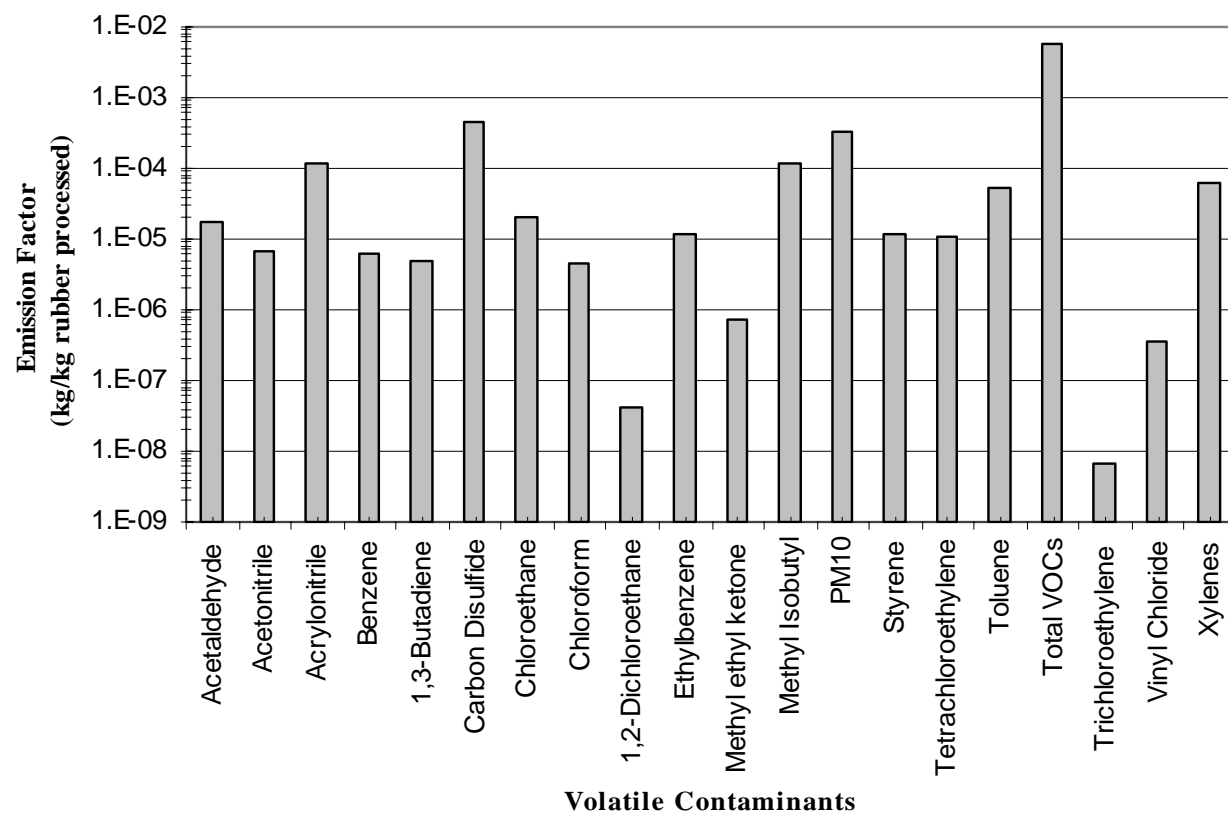
Source: 2000 U.S. Census



## Females Aged 15 - 44

Source: 2000 U.S. Census





**Figure 6: VOC emission factors for rubber product manufacturing plants**



Figure 7: Annual average ambient toluene concentration isopleths (concentrations in  $\mu\text{g}/\text{m}^3$ )



**Photograph 1: Residences built on Mercer Rubber Company site**



**Photograph 2: Sayen Gardens located to the north of the Mercer Rubber Company site (across Mercer Street)**



**Photographs 3: The Sayen House**



**Photographs 4: Unnamed creek which flows into the Miry Run Brook**



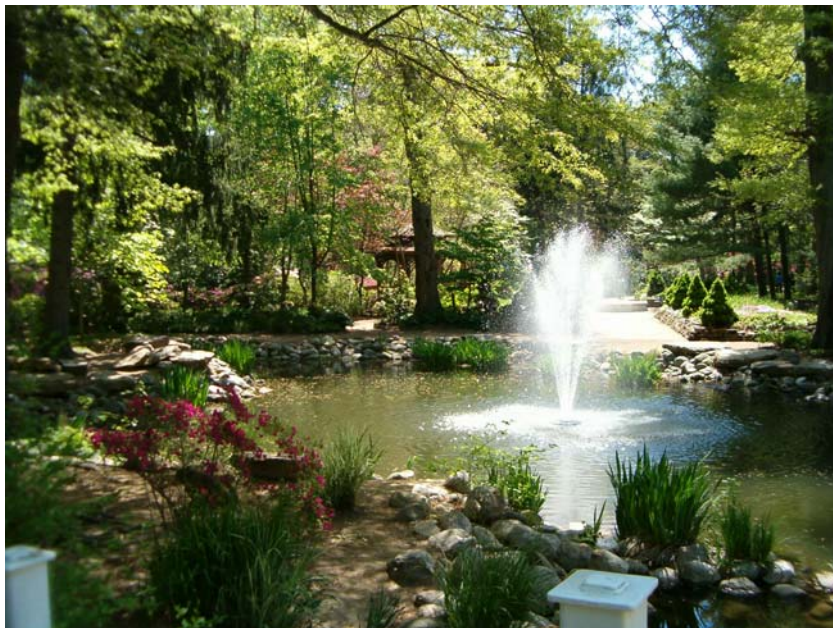
**Photograph 5: Outfall pipes draining into the unnamed creek**



**Photograph 6: Pond (referred to as the ice skating pond) located adjacent to the Township Athletic Baseball Fields**



**Photograph 7: Gazebo located adjacent to the Sayen House**



**Photograph 8: The second pond located to the west of the Sayen House**



**Photograph 9: The waste disposal area located approximately 500 feet to the north of the Sayen House**



**Photograph 10: Solid rubber waste (conveyer belts)**

**Appendix A**

**Toxicologic Summaries**

The toxicological summaries provided in this appendix are based on ATSDR's ToxFAQs (<http://www.atsdr.cdc.gov/toxfaq.html>). Health effects are summarized in this section for the chemicals of concern found off-site in area private wells. The health effects described in the section are typically known to occur at levels of exposure much higher than those that occur from environmental contamination. The chance that a health effect will occur is dependent on the amount, frequency and duration of exposure, and the individual susceptibility of exposed persons.

**PCE** PCE is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell PCE when it is present in the air at a level of 1 part per million (1 ppm) or more, although some can smell it at even lower levels. People are commonly exposed to PCE when they bring clothes from the dry cleaners.

High concentrations of PCE can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been exposed to high concentrations. In industry, most workers are exposed to levels lower than those causing obvious nervous system effects, although more subtle neurological effects are possible at the lower levels. The health effects of breathing in air or drinking water with low levels of PCE are not known. Results from some studies suggest that women who work in dry cleaning industries where exposures to PCE can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that PCE can cause liver and kidney damage. Exposure to very high levels of PCE can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

The U.S. Department of Health and Human Services (USDHHS) has determined that PCE may reasonably be anticipated to be a carcinogen. PCE has been shown to cause liver tumors in mice and kidney tumors in male rats.

**Lead** Lead is a naturally occurring metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. People may be exposed to lead by eating food or drinking water that contains lead, spending time in areas where lead-based paints have been used and are deteriorating, and by working in a job or engaging in a hobby where lead is used. Small children are more likely to be exposed to lead by swallowing house dust or soil that contains lead, eating lead-based paint chips or chewing on objects painted with lead-based paint.

Lead can affect many organs and systems in the body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead, for example by eating old paint chips, may develop blood anemia, severe stomachache, muscle weakness, and brain damage. A large amount of lead might get into a child's body if the child ate small pieces of old paint that contained large amounts of lead. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, however, lead can affect a child's mental and physical growth. Exposure to lead is more dangerous for young children and fetuses. Fetuses can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead.

The United States Department of Health and Human Services (USDHHS) has determined that two compounds of lead (lead acetate and lead phosphate) may reasonably be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine whether lead can cause cancer in people.

**Mercury** Mercury is a naturally occurring metal which has several forms. Metallic mercury is a shiny, silvery liquid which, when heated, can be a colorless, odorless gas. Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments. People are commonly exposed to mercury by eating fish or shellfish contaminated with methylmercury, breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels, the release of mercury from dental work, working with mercury, or practicing rituals that include mercury.

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breast milk, although the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Harmful effects due to mercury that passes from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems with their nervous and digestive systems, and kidney damage.

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

## **Appendix B**

### Summary of ATSDR Conclusion Categories

Category	Definition
1: Urgent Public Health Hazard	Applies to sites that have certain physical hazards or evidence of short-term (less than 1 year), site-related exposure to hazardous substances that could result in adverse health effects and require quick intervention to stop people from being exposed.
2: Public Health Hazard	Applies to sites that have certain physical hazards or evidence of chronic, site-related exposure to hazardous substances that could result in adverse health effects.
3: Indeterminate Public Health Hazard	Applies to sites where critical information is lacking (missing or has not yet been gathered) to support a judgment regarding the level of public health hazard.
4: No Apparent Public Health Hazard	Applies to sites where exposure to site-related chemicals might have occurred in the past or is still occurring, but the exposures are not at levels expected to cause adverse health effects.
5: No Public Health Hazard	Applies to sites where no exposure to site-related hazardous substances exists.

## **Appendix C**

## **ATSDR Glossary of Terms**

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

### **General Terms**

#### **Absorption**

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

#### **Acute**

Occurring over a short time [compare with chronic].

#### **Acute exposure**

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

#### **Additive effect**

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

#### **Adverse health effect**

A change in body function or cell structure that might lead to disease or health problems

#### **Aerobic**

Requiring oxygen [compare with anaerobic].

#### **Ambient**

Surrounding (for example, ambient air).

#### **Anaerobic**

Requiring the absence of oxygen [compare with aerobic].

**Analyte**

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

**Analytic epidemiologic study**

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

**Antagonistic effect**

A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

**Background level**

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

**Biodegradation**

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

**Biologic indicators of exposure study**

A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

**Biologic monitoring**

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

**Biologic uptake**

The transfer of substances from the environment to plants, animals, and humans.

**Biomedical testing**

Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

**Biota**

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

**Body burden**

The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

**CAP** [see Community Assistance Panel.]

**Cancer**

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

**Cancer risk**

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

**Carcinogen**

A substance that causes cancer.

**Case study**

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

**Case-control study**

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

**CAS registry number**

A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

**Central nervous system**

The part of the nervous system that consists of the brain and the spinal cord.

**CERCLA** [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

**Chronic**

Occurring over a long time [compare with acute].

**Chronic exposure**

Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

**Cluster investigation**

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

**Community Assistance Panel (CAP)**

A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

**Comparison value (CV)**

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

**Completed exposure pathway** [see exposure pathway].

**Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)**

CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

**Concentration**

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

**Contaminant**

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

**Delayed health effect**

A disease or an injury that happens as a result of exposures that might have occurred in the past.

**Dermal**

Referring to the skin. For example, dermal absorption means passing through the skin.

**Dermal contact**

Contact with (touching) the skin [see route of exposure].

**Descriptive epidemiology**

The study of the amount and distribution of a disease in a specified population by person, place, and time.

**Detection limit**

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

**Disease prevention**

Measures used to prevent a disease or reduce its severity.

**Disease registry**

A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

**DOD**

United States Department of Defense.

**DOE**

United States Department of Energy.

**Dose (for chemicals that are not radioactive)**

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

**Dose (for radioactive chemicals)**

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

**Dose-response relationship**

The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

**Environmental media**

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

**Environmental media and transport mechanism**

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

**EPA**

United States Environmental Protection Agency.

**Epidemiologic surveillance** [see Public health surveillance].

**Epidemiology**

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

**Exposure**

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

**Exposure assessment**

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

**Exposure-dose reconstruction**

A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

**Exposure investigation**

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

**Exposure pathway**

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

**Exposure registry**

A system of ongoing followup of people who have had documented environmental exposures.

**Feasibility study**

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

**Geographic information system (GIS)**

A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

**Grand rounds**

Training sessions for physicians and other health care providers about health topics.

**Groundwater**

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

**Half-life ( $t_{1/2}$ )**

The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

**Hazard**

A source of potential harm from past, current, or future exposures.

**Hazardous Substance Release and Health Effects Database (HazDat)**

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

**Hazardous waste**

Potentially harmful substances that have been released or discarded into the environment.

**Health consultation**

A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

**Health education**

Programs designed with a community to help it know about health risks and how to reduce these risks.

**Health investigation**

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

**Health promotion**

The process of enabling people to increase control over, and to improve, their health.

**Health statistics review**

The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

**Indeterminate public health hazard**

The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

**Incidence**

The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

**Ingestion**

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

**Inhalation**

The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

**Intermediate duration exposure**

Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

**In vitro**

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

**In vivo**

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

**Lowest-observed-adverse-effect level (LOAEL)**

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

**Medical monitoring**

A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

**Metabolism**

The conversion or breakdown of a substance from one form to another by a living organism.

**Metabolite**

Any product of metabolism.

**mg/kg**

Milligram per kilogram.

**mg/cm<sup>2</sup>**

Milligram per square centimeter (of a surface).

**mg/m<sup>3</sup>**

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

**Migration**

Moving from one location to another.

**Minimal risk level (MRL)**

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

**Morbidity**

State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

**Mortality**

Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

**Mutagen**

A substance that causes mutations (genetic damage).

**Mutation**

A change (damage) to the DNA, genes, or chromosomes of living organisms.

**National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)**

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

**National Toxicology Program (NTP)**

Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

**No apparent public health hazard**

A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

**No-observed-adverse-effect level (NOAEL)**

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

**No public health hazard**

A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

**NPL** [see National Priorities List for Uncontrolled Hazardous Waste Sites]

**Physiologically based pharmacokinetic model (PBPK model)**

A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

**Pica**

A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

**Plume**

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

**Point of exposure**

The place where someone can come into contact with a substance present in the environment [see exposure pathway].

**Population**

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

**Potentially responsible party (PRP)**

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

**ppb**

Parts per billion.

**ppm**

Parts per million.

**Prevalence**

The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

**Prevalence survey**

The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

**Prevention**

Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

**Public availability session**

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

**Public comment period**

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

**Public health action**

A list of steps to protect public health.

**Public health advisory**

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

**Public health assessment (PHA)**

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

**Public health hazard**

A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

**Public health hazard categories**

Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

**Public health statement**

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

**Public health surveillance**

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

**Public meeting**

A public forum with community members for communication about a site.

**Radioisotope**

An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

**Radionuclide**

Any radioactive isotope (form) of any element.

**RCRA** [see Resource Conservation and Recovery Act (1976, 1984)]

**Receptor population**

People who could come into contact with hazardous substances [see exposure pathway].

**Reference dose (RfD)**

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

**Registry**

A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

**Remedial investigation**

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

**Resource Conservation and Recovery Act (1976, 1984) (RCRA)**

This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

**RFA**

RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

**RfD** [see reference dose]

**Risk**

The probability that something will cause injury or harm.

**Risk reduction**

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

**Risk communication**

The exchange of information to increase understanding of health risks.

**Route of exposure**

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

**Safety factor** [see uncertainty factor]

**SARA** [see Superfund Amendments and Reauthorization Act]

**Sample**

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

**Sample size**

The number of units chosen from a population or an environment.

**Solvent**

A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

**Source of contamination**

The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

**Special populations**

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

**Stakeholder**

A person, group, or community who has an interest in activities at a hazardous waste site.

**Statistics**

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

**Substance**

A chemical.

**Substance-specific applied research**

A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

**Superfund** [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]

**Superfund Amendments and Reauthorization Act (SARA)**

In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

**Surface water**

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

**Surveillance** [see public health surveillance]

**Survey**

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

**Synergistic effect**

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

**Teratogen**

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

**Toxic agent**

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

**Toxicological profile**

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

**Toxicology**

The study of the harmful effects of substances on humans or animals.

**Tumor**

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

**Uncertainty factor**

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

**Urgent public health hazard**

A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

**Volatile organic compounds (VOCs)**

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:

Environmental Protection Agency (<http://www.epa.gov/OCEPaterms/>)

National Center for Environmental Health (CDC)  
(<http://www.cdc.gov/nceh/dls/report/glossary.htm>)

National Library of Medicine (NIH)  
(<http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>)

For more information on the work of ATSDR, please contact:

Office of Policy and External Affairs  
Agency for Toxic Substances and Disease Registry  
1600 Clifton Road, N.E. (MS E-60)  
Atlanta, GA 30333  
Telephone: (404) 498-0080